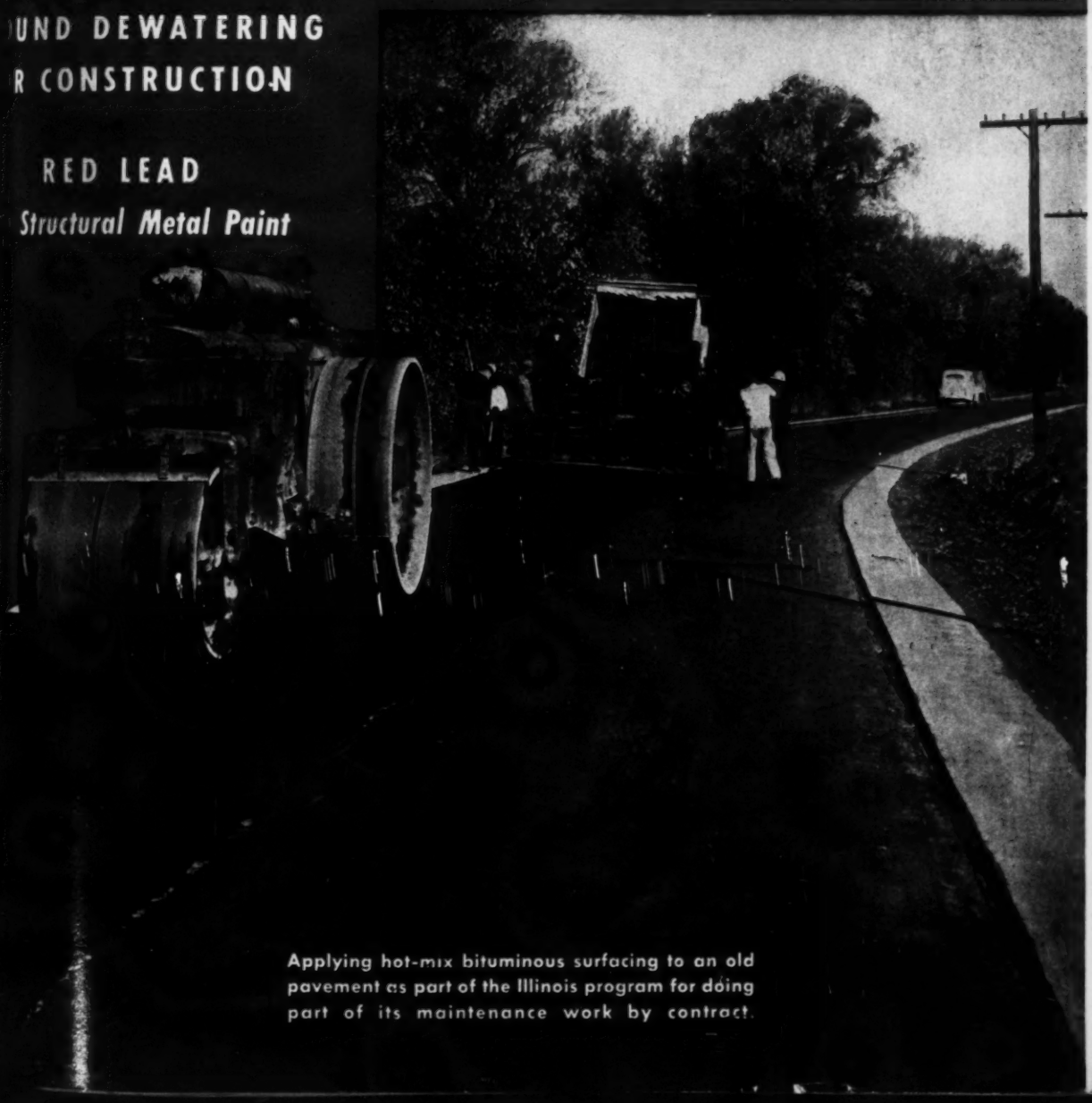
APR 12 1944

ENGINEERING NEWS-RECORD

APRIL 6, 1944

UND DEWATERING
R CONSTRUCTION

RED LEAD
Structural ***Metal Paint***



Applying hot-mix bituminous surfacing to an old pavement as part of the Illinois program for doing part of its maintenance work by contract.

are you planning now for BETTER POSTWAR HIGHWAYS?

When Victory is won, your highway con tion plans will play a vital part in makin for returning service men and workers fr war industries. It is desirable and impo that these plans be ready.

It is also important that they be "plans for the future." Postwar highways not be subject to the ills of so many o present roads, where annual breakups maintenance budgets and delay traffic.

Experience proves that wet and so subgrades are a major cause of road sur failures. Isn't it logical to make certain postwar roads are built on a stable fou tion? You can help do this by specif ARMCO Perforated Pipe wherever it is nee to intercept and remove harmful grou water. Then maintenance costs will rem low while traffic enjoys a smooth, safe, interrupted ride.

So include ARMCO Perforated Pipe in y plans for the future, even though you m not be able to get it for immediate const tion. You'll like its flexible corrugated me strength, tight joints, and immunity to d age from shifting soils, traffic impact or so frost action. Write for whatever informa you may need. Armco Drainage Prod Association, 415 Curtis St., Middletown,

ARMCO

ARMCO PERFORATED PIPE

CONSTRUCTION TRENDS

Notes on significant movements in the construction industry

Postwar Highway and Bridge Construction

HIGHWAY AND BRIDGE projects proposed for postwar construction during 1943 total $1,677,104,000—$1,256,898,000 for highways, and $420,206,000 for bridges. These proposed projects account for 32.8 percent of the $5,101,087,000 total of proposed construction, with highways responsible for 24.6 percent and bridges for 8.2 percent.

Of the proposed highway volume, $509,134,000, or 41 percent has plans underway or completed. These projects in the planning stage amount to 31 percent of the $1,647,960,000 reported to *ENR* in 1943 for all types of construction with plans underway or completed.

A comparison of the proposed highway volume with *ENR* annual budget estimates for postwar highway construction shows that the proposed volume exceeds the minimum annual budget, $815,000,000, by 54 percent, but is 23 percent below the maximum, $1,630,000,000. Planning stage volume is 37.5 percent below the minimum budget, and 69 percent under the maximum.

Bridge projects with plans underway or completed total $236,851,000 and make up 56 percent of the proposed bridge volume in 1943, the best record reported for any class of construction, as far as the portion of proposed work in the planning stage is concerned.

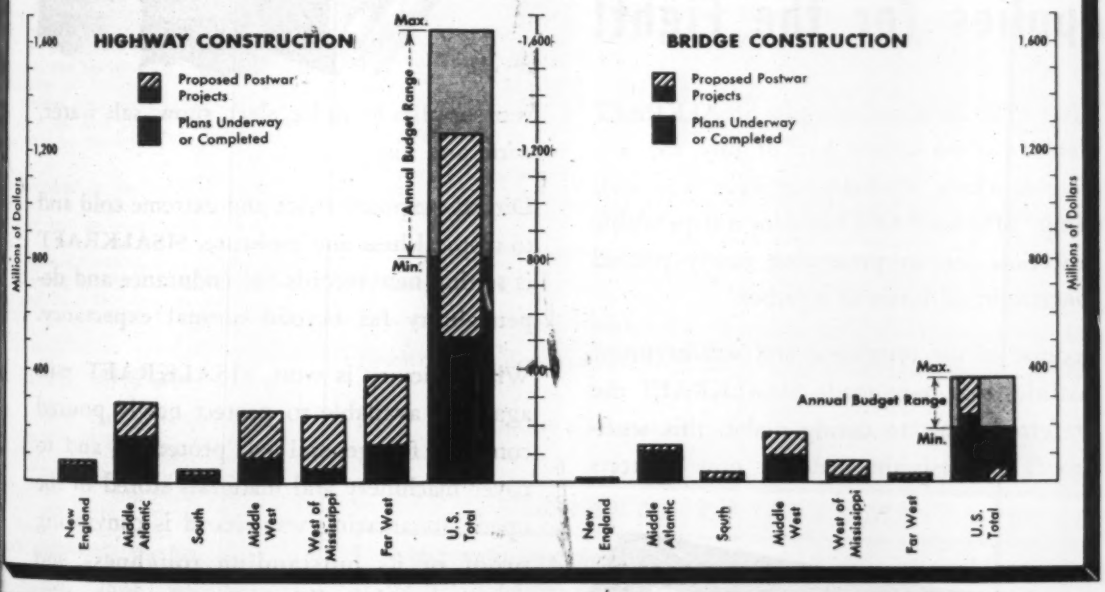
Proposed bridge volume tops the maximum annual budget of $370,000,000 by 13.5 percent, and in so doing, exceeds the minimum budget, $185,000,000, by 127 percent. Bridge projects in the planning stage already exceed the minimum year's budget by 28 percent and are within 36 percent of the maximum.

With a proposed highway total of $378,874,000, the Far West tops all other sections, and with 34 percent of these projects with plans underway or completed, takes second place in the planning stage. Middle Atlantic leads the planners with $157,220,000 in the planning stage, 55 percent of its proposed volume.

Middle West with $168,659,000 in proposed bridge projects leads the nation. This section has $95,907,000 with plans underway or completed, 57 percent of its proposed total. Middle Atlantic leads in the planning stage with a volume of $113,433,000, 88 percent of its proposed total in 1943.

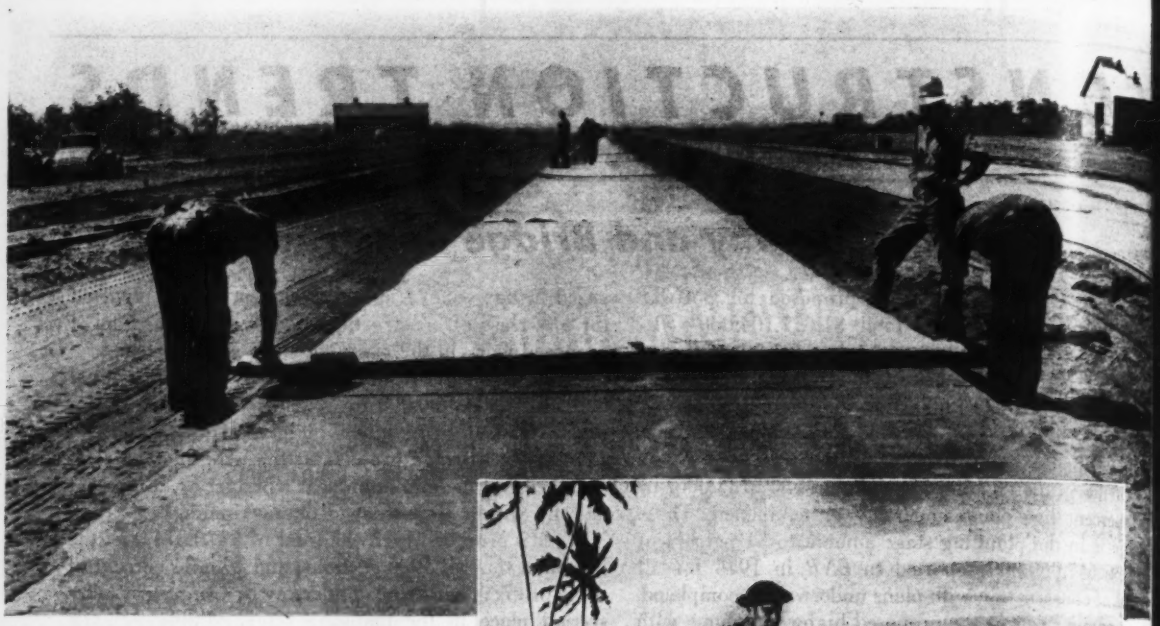
POSTWAR HIGHWAY AND BRIDGE CONSTRUCTION—BY REGIONS

(Proposed and Planning Stage Volume Reported to ENR in 1943)



ENGINEERING NEWS-RECORD. Published every Thursday. Return postage guaranteed. Vol. 132, No. 14. Price 25c per copy. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, 99-129 N. Broadway, Albany, 1, N. Y., or 330 W. 42nd Street, New York, 18, N. Y. Subscriptions, United States, U. S. Possessions and Latin American Republics, $5.00 for one year, $8.00 for two years, $10.00 for three years. Canada, $6.00 for one year, $10.00 for two years, $12.00 for three years. Great Britain and British Possessions 60 shillings for one year, 120 shillings for three years. All other countries, $9.00 for one year, $18.00 for three years. Entered as second-class matter October 29, 1936, at the Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in the U.S.A. Cable Address: "McGrawhill New York." Member A.B.P. Member A.B.C. Copyright 1944 by McGraw-Hill Publishing Company, Inc. James H. McGraw, Founder and Honorary Chairman; James H. McGraw, Jr., President; Howard Ehrlich, Executive Vice-President for Business Operations; John Shepherd Bonbrink, Executive Vice-President for Editorial Operations; Curtis W. McGraw, Treasurer; Joseph A. Gerardi, Secretary; J. E. Blackburn, Jr., Circulation Manager. Publication office: 99-129 North Broadway, Albany, 1, N. Y. Editorial and Executive Offices: 330 West 42nd St., New York, 18. District Managers and Branch Offices: Harold G. Hudson, 520 N. Michigan Ave., Chicago 11; 738-9 Oliver Building, Pittsburgh; J. W. Otterson, 68 Post St., San Francisco, 4; Aldwych House, Aldwych, London, W. C. 2, England; Washington; J. M. Spackman, New York; A. B. Cozzens, Philadelphia; E. E. Duff, Jr., Cleveland; B. F. Horn, Detroit and Chicago; Richard Y. Fuller, St. Louis; B. N. Phelan, Los Angeles; J. L. Ballard, Boston; Ralph Maultsby, Atlanta, Ga.

Table of Contents—See Page 49



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When Victory is won, SISALKRAFT will again be available to protect newly poured concrete, for general job protection and to cover machinery and materials stored in the open. Its amazing war record is convincing proof of its outstanding toughness and weatherproof qualities.

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JOHN ABBINK, *Publisher*

WALDO G. BOWMAN, *Editor* ALBERT E. PAXTON, *Manager*

132 APRIL 6, 1944 No. 14

...MING NEXT

...CIAL SECTION ON CONSTRUC... COSTS—Keeping a finger on ...pulse of construction costs is ... to be of paramount impor... in the months ahead. For this ...n the Annual Special Section ...Construction Costs to be pub...d in the April 20 issue should ... more than usual value. In it ...reader will find data on all of ...ost indexes, general and special, ...r rates, material prices, insur... rates and housing costs, and ...ddition many pages of unit ...s on jobs that were let in ... There will also be several ...al articles relating to cost and ...ating problems.

...nstruction in the postwar world ... be carried out with greater ...d and with less effort as a re... of the many unique develop...ts in equipment and practice ...red by the necessities of war. ... of the most useful of these, ...cially for peacetime river and ...or work, will be the Navy's ... 7 x 5-ft. pontoon units now ...g used the world over for rapid ...truction of causeways, bridges, ..., barges and even drydocks. ...t they are and how they work ...be told in the April 20 issue.

...so featured in the April 20 is... —How a 1,200-ton steel bridge ...e was cut to earth with ther... in forty seconds. Soft... ...nd Tunnel Construction; "Two... ..." Welding for Worn Equipment ...; and Part II—Ground Dewa...g for Construction.

...OKING AHEAD

... is evident that an unusually ... program of movable bridge ...truction will be undertaken ... in the postwar period. Gen... Electric Co. engineers have ... an exhaustive study of the ... design developments in op...nal equipment, electrical fa...es and safety devices that will ...obtainable. These will be ...ibed in an early issue.

...ANE TABLE VS TRANSIT for ...GRAPHICAL MAPPING, scheduled ...n early issue will be of special ...st to the younger men. The ...timers" too will find much food ...ought in this article.

	PAGE
The Week's Events	53
Reader Comment	61
Editorials	64
Illinois Contracts Highway Maintenance.....C. M. HATHAWAY	66
Red-Lead Paint for Structural Work.....L. L. CARRICK	70
Straw Mulch Lays Dust on Airfield	75
Water and Sewerage Problems in Latin America MAJ. A. E. WILLIAMSON	76
Technical Institutes Proposed in Canada	80
Ground Dewatering for Construction—Part I.....R. NEBOLSINE	81
Railway Engineers Review War and Postwar Problems	86
Railroad Lift Bridge Raised Eighteen Feet	88
Rainfall Distribution at Louisville.....C. F. JOHNSON	92
Chilean Rail Lines are Improved	93
From Field and Office	94
Book Notes and Reviews	95
Faith of the Engineer	97
Unit Prices	100
Material Prices	110
News of the Week (Continued)	102
New Aids to the Constructor	118
Meetings	124
Elections and Activities	126
Construction Reports	145

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New Reinforcing Bar Promises Added Economy and Efficiency

The scientific design of the new Inland Hi-Bond reinforcing bar with its reverse double helical ribs, provides vastly greater anchorage and bonding strength, keeping pace with the development of higher strength concrete. Large stocks of this new bar in a wide range of sizes are ready for immediate shipment from Ryerson. We believe the Hi-Bond bar will effect many improvements and economies for the construction industry. A bulletin giving more detailed information will be sent on request.

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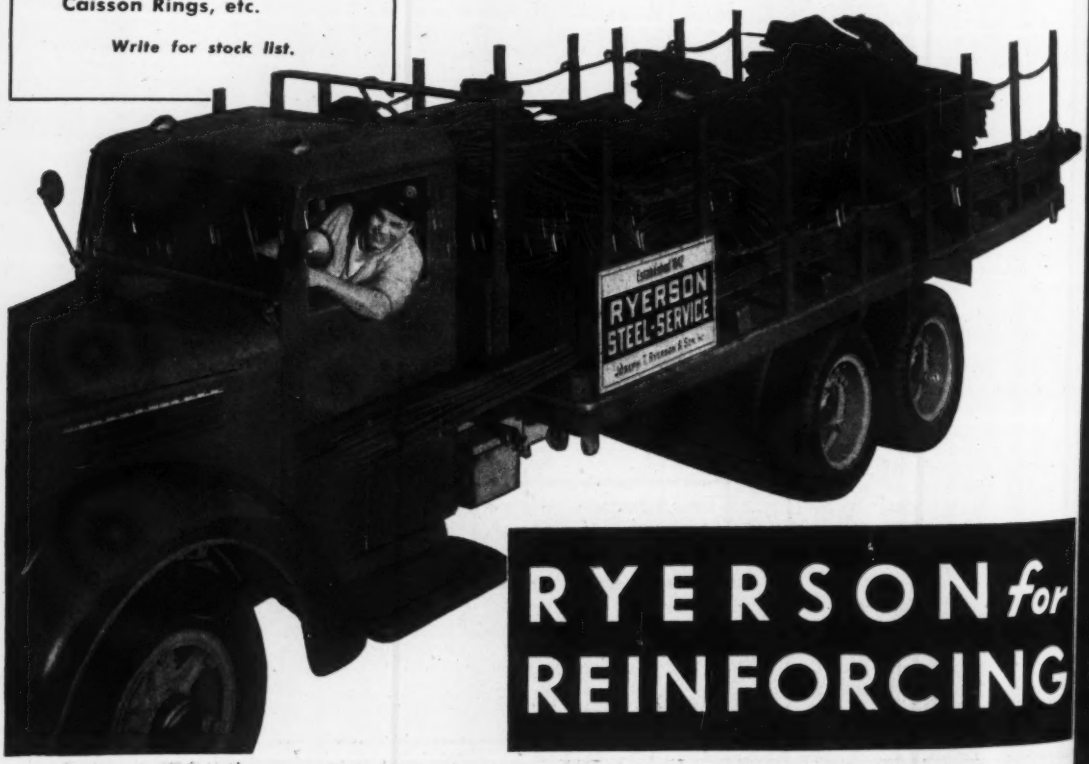


RYERSON *for* REINFORCING

ONTHLY CONSTRUCTION BUSINESS SUMMARY

ENR CONSTRUCTION VOLUME AND NEW PRODUCTIVE CAPITAL

(,000 omitted)	March 1943 (4 wk.)	March 1944 (5 wk.)	% Change†	Three Months 1943 (12 wk.)	Three Months 1944 (13 wk.)	% Change†
ental U. S. Construction	$305,973	$175,726	−54.0	$839,041	$450,122	−50.0
e Construction	29,983	45,109	+20.0	82,042	98,340	+11.0
Construction	275,990	130,617	−62.0	756,999	351,782	−57.0
al	263,708	111,974	−66.0	727,848	318,147	−60.0
New Productive Capital	$47,179	$22,837	−61.0	$62,718	$181,638	+168.0
e Investment	44,091	20,872	−62.0	58,130	83,266	+32.0
al (non-federal work)	3,088	1,965	−49.0	4,588	7,540	+52.0
al (federal work)	.....	.....	.....	.....	90,832	.....
R Construction Volume Index, = 100	228	103	−55.0	210*	101*	−52.0

† *Adjusted for difference in number of weeks reported.* * *Three-month average.*

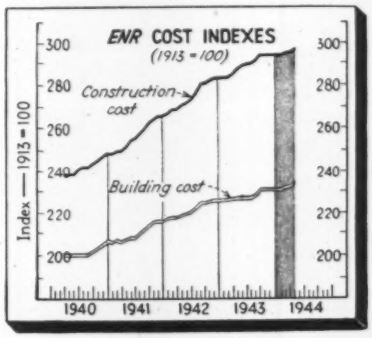
STRUCTION COSTS . . . WAGE RATES . . . MATERIAL PRICES

	April 1943	April 1944	% Change	Change March to April 1943 Mar.	1943 Apr.	1943 %	1944 Mar.	1944 Apr.	1944 %
R Construction Cost ex, 1913 = 100†	288.80	297.70	+3.1	285.24	288.80	+1.2	295.34	297.70	+0.8
Building Cost Index, = 100†	227.50	234.50	+3.1	226.66	227.50	+0.4	232.32	234.50	+0.9

† *Does not reflect increased costs due to more overtime, lower labor efficiency, delivery delays, etc.*

ENR 20-CITIES' AVERAGE

on labor	$0.858	$0.874	+1.9	$0.842	$0.858	+1.9	$0.870	$0.874	+0.5
l labor (Av. 3 trades)	1.613	1.632	+1.2	1.606	1.613	+0.4	1.623	1.632	+0.6
ayers	1.703	1.726	+1.4	1.700	1.703	+0.2	1.715	1.726	+0.6
ural Ironworkers	1.671	1.688	+1.0	1.661	1.671	+0.6	1.680	1.688	+0.5
nters	1.465	1.481	+1.1	1.457	1.465	+0.5	1.473	1.481	+0.5
nt, per bbl	$2.61	$2.62	+0.4	$2.61	$2.61	0	$2.62	$2.62	0
rcing steel, cwt	2.74	2.79	+1.8	2.74	2.74	0	2.79	2.79	0
ural steel, base	2.10	2.10	0	2.10	2.10	0	2.10	2.10	0
per ton	1.21	1.23	+1.7	1.21	1.21	0	1.23	1.23	0
er, 2x4 Fir, per M ft.	51.05	53.99	+5.8	51.05	51.05	0	53.45	53.99	+1.0
er, 2x4 Pine, per M ft.	44.66	52.20	+16.9	44.01	44.66	+1.5	49.88	52.20	+4.7
common, per M	15.63	16.20	+3.6	15.66	15.63	−0.2	16.20	16.20	0
-mixed concrete, c.y.	7.37	7.39	+0.3	7.39	7.37	−0.3	7.42	7.39	−0.4
clay tile, 3x12x12-in.	78.93	79.34	+0.5	78.93	78.93	0	79.34	79.34	0
asphalt, cars, ton	15.21	15.25	+0.3	15.12	15.21	+0.6	15.25	15.25	0



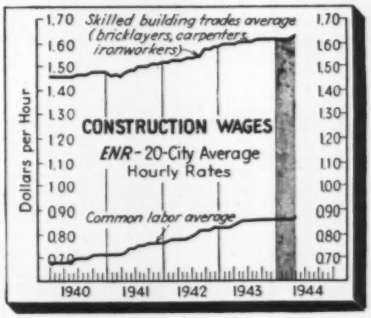
ENR INDEX NUMBERS

Base = 100	Construction Cost 1913	Construction Cost 1926	Building Cost 1926	Building Cost 1926	Volume '13	Volume '26
April, 1944	297.70	143.10	234.50	126.76	.....	.....
Mar., 1944	295.34	141.97	232.32	125.59	103	45
Feb., 1944	295.05	141.83	232.03	125.43	86	38
Jan., 1944	294.57	141.60	231.55	125.17	114	50
Dec., 1943	294.51	141.57	231.49	125.14	103	45
Nov., 1943	294.41	141.52	231.39	125.08	149	65
Oct., 1943	294.31	141.47	231.29	125.03	142	62
Sept., 1943	294.09	141.37	231.20	124.98	155	68
Aug., 1943	291.38	140.07	228.49	123.51	119	52
July, 1943	289.92	139.36	227.89	123.19	175	77
June, 1943	289.94	139.37	227.71	123.09	204	89
May, 1943	289.87	139.34	227.64	123.06	203	89
April, 1943	288.80	138.83	227.50	122.98	225	99
Mar., 1943	285.24	137.11	226.66	122.53	228	100
Feb., 1943	283.48	136.27	226.90	122.66	231	101
1943 (Av.)	289.95	139.38	228.75	123.66	176	77
1942 (Av.)	276.31	132.82	222.39	120.22	553	243
1941 (Av.)	257.84	123.95	211.46	114.32	375	164
1940 (Av.)	241.96	116.31	202.81	109.64	269	118

MATERIAL SHIPMENTS . . . . BUILDING PERMITS

	March 1943	March 1944	% Change	Feb. 1944	% Change Feb.-Mar.
(% operating capacity) A. I. S. I.	99.3	98.7	−0.6	97.4	+1.3

	February 1943	February 1944	% Change	Two Months 1943	Two Months 1944	% Change
ated structural steel, tons, A. I. S. C.	90,849	32,541	−64.2	182,738	60,249	−67.0
t, thous. bbl., U. S. B. of M	8,656	5,055	−41.6	17,297	10,102	−41.6
ng permits, 215 cities, Dun & Brad-et (,000 omitted)	$28,637	$40,245	+40.4	$57,456	$74,188	+29.1



COST OF LIVING INDEXES . . . . EMPLOYMENT

	February 1943	February 1944	% Change	Jan. 1944	% Change Jan.-Feb.
Living Index, N. I. C. B	101.9	103.4	+1.5	103.9	−0.5
Housing) Index, N. I. C. B	90.8	90.8	0	90.8	0
Employment (est.), thous., B. L. S	37,958	37,047	−2.2	37,257	−0.5
. Employment (est.), thous., B. L. S	1,386	638	−54.0	685	−6.9

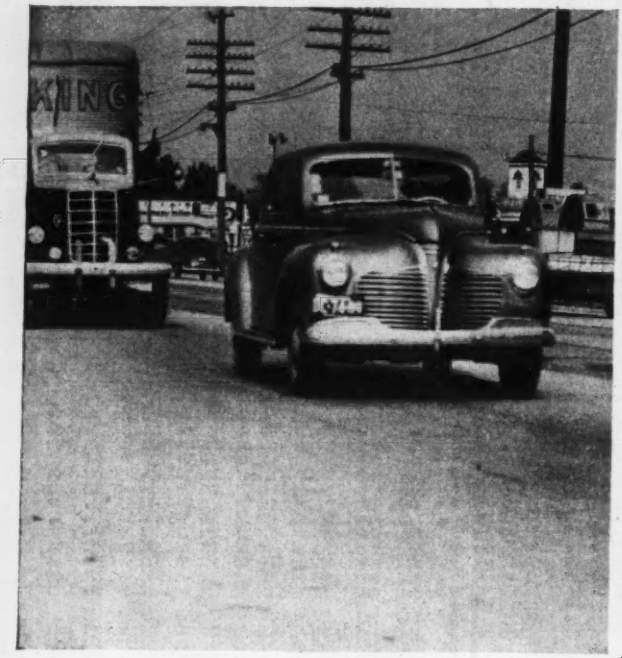
ENGINEERING CONSTRUCTION CONTRACTS—ENGINEERING NEWS-RECORD—MARCH, 1944

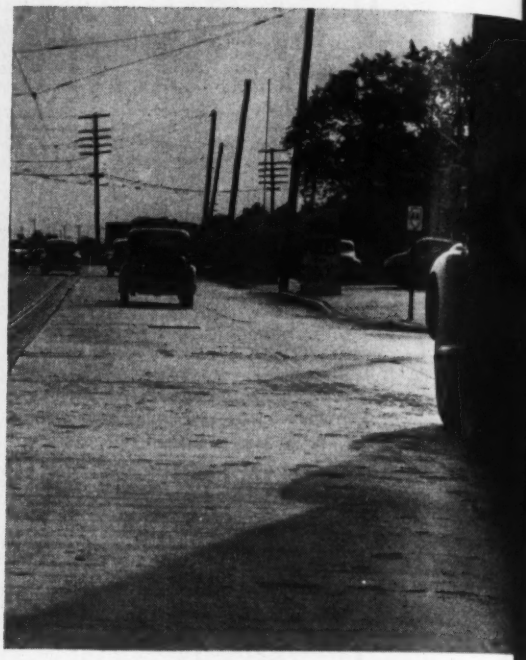
ering News-Record *reports continental U. S. Construction projects of the following minimum cost—waterworks, excavation, drainage and irrigation,* $15,000; *other public works,* $25,000; *industrial buildings,* $40,000; *other buildings,* $150,000

Five Weeks—Thousands of Dollars (000 Omitted)

Works	New England	Middle Atlantic	South	Mid West	West of Mississippi	Far West	United States March 1944	United States Three Months 1944	United States Three Months 1943	Canada
Waterworks	35	59	614	538	395	466	2,107	6,403	11,677	60
Sewerage	92	590	464	84	587	614	2,431	6,029	9,984	53
Bridges, public	.....	.....	100	.....	27	257	384	1,360	4,905	.....
Earthwork and waterways	.....	98	111	207	899	3,069	4,384	14,646	4,617	.....
Streets and roads	200	1,055	4,011	6,090	1,945	1,522	14,823	26,314	36,155	556
Buildings, public	1,774	9,041	12,099	6,247	8,034	26,946	64,141	188,279	459,780	430
Unclassified, public	799	3,215	11,899	363	5,174	20,897	42,347	108,751	229,881	6,296
Public	**2,900**	**14,058**	**29,298**	**13,529**	**17,061**	**53,771**	**130,617**	**351,782**	**756,999**	**7,395**
Federal government (included in above classifications)	2,682	12,823	24,726	6,721	14,759	50,263	111,974	318,147	727,848	.....
Bridges, private	.....	.....	.....	.....	.....	.....	.....	870	1,550	.....
Industrial buildings	286	697	7,952	6,479	3,036	1,129	19,579	39,979	37,944	4,927
Commercial buildings	185	1,519	980	2,230	925	14,621	20,460	49,473	35,233	150
Unclassified, private	.....	35	624	104	4,234	73	5,070	8,018	7,315	120
Private	**471**	**2,251**	**9,556**	**8,813**	**8,195**	**15,823**	**45,109**	**98,340**	**82,042**	**5,197**
Engineering Construction 1944—5 weeks	**3,371**	**16,309**	**38,854**	**22,342**	**25,256**	**69,594**	**175,726**	.....	.....	**12,592**
1944—4 weeks	**4,720**	**30,974**	**16,266**	**14,413**	**26,716**	**24,789**	**117,878**	.....	.....	**3,146**
1943—4 weeks	**9,763**	**49,315**	**54,236**	**30,879**	**84,941**	**76,839**	**305,973**	.....	.....	**8,183**
Months—1944	**12,397**	**66,819**	**71,894**	**49,091**	**72,468**	**177,453**	.....	**450,122**	.....	**17,142**
Months—1943	**36,680**	**101,635**	**183,315**	**85,220**	**207,300**	**224,891**	.....	.....	**839,041**	**23,084**

AIR-ENTRAINING CEMENT REQUIRED FOR ALL STAT CONCRETE HIGHWAYS IN METROPOLITAN CHICAG





Test installations on South Archer Avenue, Chicago, laid in 1941 and photographed in 1943. Left: eastbound lane placed with Atlas Duraplastic is practically scale-free. Right: westbound lane placed with normal portland cement shows scaling after two winters of identical salt de-icing treatments.

Atlas Duraplastic* proves scale-resisting value of air-entraining portland cement on test pavement installation

Archer Avenue, the main highway from downtown Chicago to the municipal airport, was chosen by the Illinois Division of Highways for a test installation of air-entraining portland cement. The results of two winters' exposure to heavy applications of de-icing salts (pictured above), show how Atlas Duraplastic met the test. Duraplastic pavements in other states and cities have uniformly duplicated results of this test. Some of these installations are now in their fifth winter, and all are practically scale-free.

Atlas Duraplastic is a true portland cement in which a small quantity of air-entraining material, in an amount precisely determined for uniform performance, is interground during manufacture. Its effectiveness in protecting concrete against the effects of freezing and thawing weather and against scaling due to salts used for ice removal is the result of more th eight years of research and te by Universal Atlas in the labo tory, in the plant and on the j

For reprints of articles fr technical journals and for detai information on Atlas Duraplas write to Technical Service Bure Universal Atlas Cement Compa (United States Steel Corporati Subsidiary), Chrysler Bldg., N York 17, N. Y.

. . .

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ATLAS DURAPLASTIC CEMENT
A Universal Atlas Product

The Week In Engineering and Construction

GINEERING NEWS-RECORD • APRIL 6, 1944 • VOLUME 132 • NUMBER 14

WPB relaxes specifications to permit use of more steel

einforcing in concrete may be increased 5 per cent, re-establishing peacetime design practice. Structural eel jobs up to 5 tons exempt from restrictions.

tional emergency specifications for rced concrete buildings (WPB Di- e 9) have been amended to in- e the amount of reinforcing steel may be utilized, to exempt from provisions small projects using han 5 tons of steel, and to eliminate of the paper work requirements he construction industry, the Con- tion Division of the War Produc- Board announced April 3.

similar reduction in paper work made in Directive 8, governing tural steel for buildings, and Di- ve 29, governing stress grade lum- for buildings. Simultaneously, Di- ve 8 was amended to exempt from pecification provisions any project less than 5 tons of steel.

e amendments to the three direc- became effective March 30, 1944. ese specifications have been in for varying periods and govern n of buildings whose construction anced or approved by government tments or agencies. In general, require the most simplified form nstruction possible, as a measure nserving materials and labor dur- he war.

Smaller beams and columns

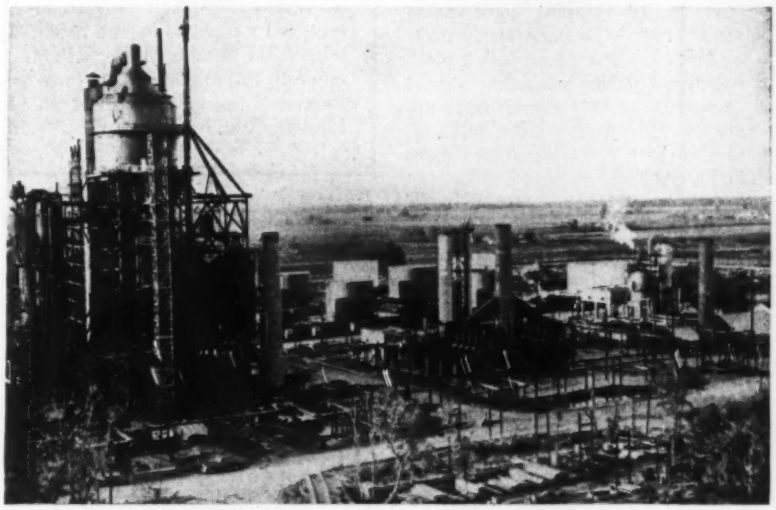
reinforced concrete construction, Directive 9 is amended to permit e of about 5 percent more reinforc- eel, with a consequent reduction of 10 percent in the size of concrete and columns. This will re-estab- esign practices which were in com- use before the war. From now will not be necessary for building ers to file a certificate declaring he National Emergency Specifica- r the Design of Reinforced Con- Buildings has been followed. ng projects involving the use of 5 less of reinforcing steel are now from the necessity for complying with the national emergency specifications.

Howard Coonley, Director of the Conservation Division, explained that with reference to the technical details of designing, the amendment removes the former preferences given to the use of non-reinforced concrete or masonry in the construction of footings, walls, piers, retaining walls and buttresses. It also removes the necessity for the use of extra deep members formerly required to save reinforcing steel. The extreme fibre stress in compression in flexural members has been increased from 0.35 to 0.45 of the ultimate strength of the concrete. The ratio of vertical reinforcement in spirally reinforced columns has been changed to permit a minimum of 0.01 and a maximum of 0.08. Similarly, the ratio of vertical reinforcement in tied reinforced columns has been changed to permit a minimum of 0.01 and a maximum of 0.04.

However, the increased working stresses in reinforcing steel required by the original emergency specifications have not been modified in this amendment.

"The main purpose in amending Directive 9 is to ease the situation with

(*Continued on page* 59)



DPC'S 100-octane plant produces 9-cent gasoline

All of the refining units for the $23,000,000 aviation gasoline plant at Sweeney, Tex., were completed in early February, after a construction period of a year and a half which began in July 1942. The first refining unit was put in operation last October. The project is the Defense Plant Corporation's Plancor 880, and is one of the two plants in the entire 100-octane gasoline construction program to have been undertaken in its entirety. Other projects have consisted of expanding facilities or adding new units to existing refineries.

J. F. Pritchard & Co., of Kansas City, was the general contractor. The company, during the last few months of construction, employed approximately 1700 men. The project is to be operated on a non-profit basis by the Abercrombie-Harrison Oil Co., which is to deliver 100-octane gasoline to the government at a total cost of about nine cents per gallon.

The completed refinery includes the following units: crude distillation, thermal reforming, two-stage fluid catalytic cracking, gas concentration, hydrofluoric alkylation, butane isomerization, and the utilities to operate these. The illustration above is a general view, showing the crude, reforming and catalytic cracking units.

War-developed construction ideas will aid peacetime public works

New developments in equipment and materials to be of practical value on future projects, Col. H. J. Woodbury tells engineers and public officials

With the characteristic dispatch and directness of an Army engineer who knows whereof he speaks, Col. H. J. Woodbury, district engineer, Army Corps of Engineers, Chicago, last week told a packed audience of engineers and public works officials about some of the wartime developments in equipment and materials as they will apply to peacetime public works.

Addressing the initial luncheon of the year held by the Chicago Metropolitan Chapter of the American Public Works Association, Col. Woodbury wasted no time in generalizing on any idle postwar construction plans. Instead, he got right down to brass tacks and forecast a few of the wartime developed items which will appear on the construction market after the war.

For instance, he told of a war-born combination of primary and secondary rock crushers into one portable unit, designed to save shipping space and to reduce the number of replacement parts in the field. The upkeep on such a piece of equipment during peacetime should be lessened and this combination undoubtedly will effect a substantial reduction in both the original and operational costs.

Airborne construction equipment

Airborne tractors and bulldozers probably will find a definite use in public works after the war, asserted Col. Woodbury. They can be used in constructing sidewalks and in making emergency street and highway repairs since they can be transported quickly and economically. The use of such equipment may be equally applicable to the construction of bridle paths, golf courses and other recreational projects in municipal park systems.

He told of another piece of airborne construction equipment which undoubtedly will have a wide commercial use in public works programs after the war. That is the two-wheel grader designed to be drawn by tractor or jeep.

The portable steel bridges employed by the Army engineers in this war should be available for use as detours during construction of permanent bridges, declared Col. Woodbury. And along this same line, the portable pierced-plank steel landing mats now being widely used overseas may readily find a place in this country after the war in the building of temporary roads to construction projects.

Likewise, he pointed out that this pierced plank will be most suitable for emergency and standby landing strips, for all-weather road and street detours, and as an armored surface for parking lots. Another application of the pierced-plank, as well as the bar-and-rod airplane landing mat, is for grating material in power plants, he said.

Faith of the Engineer

On page 97 of this issue is published an inspirational statement prepared by the *Engineer Council for Professional Development* and presented by *Engineering News-Record* in the hope that it will stimulate the maintenance of high ethical standards in the engineering profession.

If it appeals to you as a document worthy of display, where all can see, we shall be glad to send you a copy printed on paper suitable for framing. Address your request to *Engineering News-Record, Editorial Dept.*, 330 *W.* 42nd *St., New York* 18, *N. Y.*

Electric flashing markers

Another item now being purchased by the Corps of Engineers which may find a wide municipal use during peacetime, according to Col. Woodbury, is a flasher-type electric lamp for night marking of airports, crossroads and other desired points. This economically-produced item contains a small neon bulb capable of flashing continually for a year.

These lights could be adopted for marking street and highway traffic lanes in congested areas. Also, they will make excellent airport markers, and are applicable even for serving as guide markers for night gatherings at large stadiums and ball parks, he said.

Fluorescent material

The vast development in fluorescent material, fostered by the Army engineers will find many uses during peacetime, he continued. It can be used in outlining aisles of public buildings, where the burning of small blue lamps energize the lane-marking material. T will make it unnecessary to light electric lamps in seldom used areas.

Furthermore, predicted Col. W bury, fluorescent material may be for marking traffic lanes on streets highways if the cost of such mate can be lowered. By using auxil blue driving lights on cars the fluo cent material will reflect the high centerlines or traffic lanes, he said.

Speaking of highways, he pointed that the California plan of testing load-carrying capacity of soils has b further developed by the Corps of E gineers to where the speedy evalua of supporting power and qualities soil for airport runway and high construction is available now for types of soil.

Fire-fighting equipment

Col. Woodbury was of the opin that much of the emergency fire-fi ing equipment purchased for civi defense eventually may find its way many municipalities. It could be as emergency protection on construc jobs, in city parks and in suburb areas, where the sparsely settled popu tion does not justify permanent stations.

One outstanding improvement in fi fighting apparatus, according to Woodbury, is the development of high-pressure centrifugal water pu This pump produces a high-pressure that quickly extinguishes high-oct gasoline fires. He told of a recent A demonstration at which a fire of 350 of high-octane gasoline was extingui by this high pressure fog equipment less than one minute.

The use of high pressure fog fighting equipment, as well as the proved airport crash trucks using bon dioxide gas undoubtedly will used commercially after the war aro commercial airfields, he said.

In closing, Col. Woodbury poi out that the Corps of Engineers developed little in the field of build construction that will extend into postwar era. The shortage of cri materials was given as the reason this situation. With steel supp scarce, it was necessary to resort wood and mass concrete construc in many instances. However, it was prediction that after the war steel reinforced concrete would assume l ing roles in the construction indu

Lloyd M. Johnson, commissioner streets and electricity, City of Chic is president of the Chicago Metropol Chapter of the American Public W Association. Robt. L. Anderson, sup intendent of public works, Winne Ill., is the secretary.

NGINEERING ABROAD AS SEEN BY ENR EDITORS

On the Front in New Guinea

By Nathan A. Bowers
Pacific Coast Editor, Engineering News-Record

On a tour of South Pacific bases to report on war construction, Mr. Bowers finds a moment now and then to send informal dispatches, of which this is the fourth. Earlier reports appeared in our issues of Feb. 17, p. 221, Mar. 2, p. 301 and Mar. 30, p. 439.

GUINEA, March 12—Rabaul, much he news, has been a focal point in travels. Having gone "up the Slot" eported last week, to within easy ting distance of that Jap base, retraced our steps and then ap- ched it from another angle, again stepping stones built by our con- ction forces. These stepping stones in the form of spacious bases ted for strategic value and built at eed possible only with heavy equip- t in skilled hands—an almost un- evable number of such hands.

his second approach to Rabaul em- izes the pincers action of our forces impresses one with the strength ur bases for supporting forward ement. Surely, Tojo is in a bad !

Climate slightly damp

e started our second trek toward ront from Brisbane. From the com- able climate of the "Kangaroo" con- t we took off for the long north- hop to New Guinea whose climate easily exaggerated". To avoid ex- ration, therefore, I quote from a weather record for the base where pent several days: "The annual all of 180 in. comes mostly be- n March and October. During this d monthly precipitation may ex- 30 in.; the 24-hr. figure is some- 13 in.; and frequently 4 in. will n a single shower."

r progress toward the front could be charted by elapsed time "since last bombing" at each successive At the point in New Guinea where rned back we were close to Jap ory just as the moon neared the Lt. Com. W. E. Davidson, of Oak- Cal., whose quarters I shared, re- ed "If the Nips don't come over on ght like this it will be the first light they haven't used since our ion moved in."

e reason why we were not bombed that night probably was because this battalion hadn't been there without purpose. The airstrip they helped to build in record time was busy day and night to Tojo's sorrow. In the camp we could hear a distant but almost constant roar from the warming-up stands that sounded like a swarm of angry bees. They weren't bees exactly, but rather Wasps and Hornets made in U.S.A. for the bombers and fighters that streaked out by the dozens and scores in strikes at Nip bases up the coast and over yonder on New Britain, visible from here when the clouds lift.

Proximity to the Nips was emphasized by our meeting with "Murphy"—the nickname given by M.P.'s to a Jap sergeant-major. Jap captives from New Guinea, who are now cut off from supplies, are emaciated and starved. "Murphy" was well-fed, alert, and perhaps better-mannered than we who stood about to stare at him. We sized him up as the survivor of a bomber crew.

Mosquitoes are deadly

The Japs have killed some of the construction men here, but a far more dangerous enemy is the mosquito. Malaria is well in hand. The yellow-jaundice color resultant from daily dosages of atabrine attests the faithfulness of the men in making use of this protective measure. But atabrine is no safeguard against dengue fever, and in the camp where this is being written only a few weeks ago many men in the battalion were down with dengue, which is sometimes called "break-bone" fever in the southern part of the United States.

But white men are learning how to live safely on these islands. Records of experience now being kept make for comfort and security in later developments. What these developments will be is a question often discussed by the men who have done the pioneering here —and on a rush schedule at that. These are potentially productive lands, and they have received speedy and extensive improvement.

One South Sea airfield with superb runways made of firmly compacted coral, wider and longer than even the heaviest bombers require, was recently pronounced by a high aviation authority as "the equivalent of any airport in the U. S." Not only are there airports, but also entire systems of excellent highways, piers, water systems, drainage developments and many similar works. Are we to let all these improvements revert to jungle? This is truly a major question of postwar international policy.

McGraw-Hill starts digest for overseas

An Overseas Digest, the first edition of which has just been published by the McGraw-Hill Publishing Co., has been started in response to an appeal for reading matter for troops overseas.

The McGraw-Hill Overseas Digest is designed to interest the thousands of technical men in the Army and Navy who may want to keep abreast of developments in the engineering, manufacturing, and business worlds which they have temporarily left behind.

Printed on light paper to facilitate shipping, the digest measures 5⅜x7¾ in. and contains a selection of material from McGraw-Hill publications.

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County claims damage from military trucks

Madison County, Ind., has filed with the federal government claims totaling $420,610 for damage to county highways and bridges by Army and Navy equipment and vehicles up to Jan. 1 of this year.

The claims represent the amount of money that will be needed to repair the damages, Commissioner William Bosson explained.

Under an emergency measure enacted in Congress some time ago, local units of government are authorized to file such claims with the Public Roads Administration. The Indiana claim may be the forerunner of many others of a similar nature.

Ray D. Mendenhall, president of the board of county commissioners, said that in the last two years both the Army and the Navy have been using the highways and bridges daily for movement of troops and equipment, and that many roads were "completely torn up and destroyed."

News of the engineering schools

Kenneth C. Reynolds, of Massachusetts Institute of Technology, has been appointed head of the department of civil engineering at Cooper Union, New York, with the rank of full professor. He succeeds Prof. Edward S. Sheiry, who has resigned.

Reynolds supervised model studies of the Cape Cod Canal for U. S. Engineers. Now on leave of absence from M.I.T., he is in charge of a special investigation of wave action for the Bureau of Ships under the Woods Hole Oceanographic Institution. Born in Somerville, Mass., in 1897, he was graduated from Tufts College in 1919 with the degree of bachelor of science in civil engineering and from M.I.T. in 1925 as master of science.

Rensselaer Polytechnic Institute, Troy, N. Y., has organized special courses in three fields of engineering and in chemistry for the benefit of returning veterans. The courses will run for 16 months, or for two academic years under an accelerated program. The students will be prepared to be engineering assistants and laboratory technicians, or for supervisory responsibilities greater than those usually entrusted to the technical high school or vocational school graduate, and less than those usually assumed by the graduate engineer. The training will be about half that received by a student in the regular 4-year course.

The objectives are to prepare returning veterans for profitable employment as quickly as possible, and to meet needs of industry for personnel with this "in-between" training. All subjects have been selected from the regular curriculum. Instruction will be entirely on college levels, and there will be no curtailment of required standards or of admission requirements.

Duke University, Durham, N. C., and Queens College, Charlotte, N. C., in cooperation with the U. S. Commissioner of Education, will offer courses in engineering applications of mathematics. A 15-weeks school started at Charlotte, on Mar. 24. The teachers are: Wm. S. McGovock, professor, mathematics, Davidson College, and Chas. R. Vail, of the Duke College of Engineering faculty.

Clifton O. Carey, associate professor of geodesy and surveying in the college of engineering, University of Michigan, will retire soon. He is a graduate of the university and at one time was superintendent of building construction for the Sherwin-Williams Co. During the years 1918 to 1920, he acted as principal assistant engineer for the Grand Canal Improvement project in Tientsin, China.

Canadian undergraduate college students in ten professional courses, including engineering, are classed as in work "contributing to the prosecution of the war or in the national interest" and may proceed with their studies provided they make satisfactory progress. A special board, representing the War-time Bureau of Technical Personnel, the Royal Canadian Navy, the Canadian Army, and the Royal Canadian Air Force, is now visiting universities to interview students in professional and technical courses who are to graduate this year, so that they may be allocated to the appropriate service.

William D. Bliss, president of Bliss Bros. Tool Co. of Milwaukee, Wis., has been appointed dean of the College of Engineering at Marquette University to succeed Franz A. Kartak. Prof. Bliss joined the faculty as an instructor in mechanical engineering in 1914, became assistant professor in 1916, and a professor in 1919.

During the past year a number of school administrators in the technical institute group have been planning an association of technical schools that occupy that area of the educational field between the usual trade school and the strictly professional engineering school organized on an academic basis.

An organization known as the National Council of Technical Schools has been effected. After several conferences, this group has set up a tentative code of minimum standards for the field that it proposes to occupy. The Council at 839 Seventeenth St., N.W., Washington, 6, D. C., is desirous of receiving constructive suggestions with reference to these standards prior to its next meeting scheduled to be held early in May.

Engineering schools must prepare to expand rather than curtail their training program, in the opinion of W. R. Woolrich, dean at the University of Texas and regional advisor of the federal war training program for engineers.

Dean Woolrich said that stepping up of technical training will be necessary to replace skilled men called by Selective Service, and because of reconversion of war plants to civilian work where different skill is needed, and also because of the eventual return of service men who will wish to be trained for industrial jobs.

The first unit of the Armour Research Foundation's new Engineering Research Laboratory building at the Illinois Institute of Technology in Chicago was dedicated March 22. As yet the laboratory is unequipped, but the building, a reinforced-concrete structure, one story high, 100 x 125 ft., is complete. The laboratory is the second structure to be completed in the Institute's $3,100,000 campus development program. The $250,000 Metals and Minerals Research building was dedicated a year ago.

The research laboratory, costing $75,000, was designed by Ludwig Mies Van der Rohe, head of the Illinois Tech's department of architecture, and Holabird & Root, associate architects. Dahl Stedman, Chicago, was the contractor.

The School of Engineering of Columbia University is opening its spring session courses free of charge to qualified men and women engineering students who have been discharged from the armed forces. Nicholas Murray Butler, president, says:

"This plan is designed to bridge over an emergency period in education. Although large numbers of men and women have been released from the service, no government plan as yet provides for the completion of their education. It is our hope that we can aid them over the critical period of waiting until federal funds are provided for them to continue their engineering studies.

"It is highly desirable both for more and education, that those who desire to do so be given the opportunity to resume their studies and to become accustomed again to the college environment and proper study habits. It is also particularly important that those who have outstanding scientific and technical ability complete their education without delay. If the war is prolonged, their services will be essential in carrying on American war production.

"Our engineering schools have been forced by war needs to turn out large numbers of necessarily rather narrowly trained technical students. Yet postwar demands will require a high level of technical competence, a more complete educated personnel than was essential in the prewar period. Technology has made rapid strides during the war, and peace will bring new problems of development, application and design which will require the most advanced type of training, skill and general ability."

Am. Soc. C. E. establishes postwar research and development unit

Will aid private and public construction agencies in the promotion of planning activities. Smith and Owen are staff directors.

To stimulate local private interests and government units in completing engineering and architectural plans looking toward postwar employment in the construction industry, the committee on postwar construction of the American Society of Civil Engineers on March 31 created a research and development division and appointed Vincent B. Smith, associate editor of *Construction Methods* magazine, to act as executive director. The committee further recommended the appointment of Mark B. Owen, of Hastings-on-Hudson, N. Y., to serve as full-time director.

Vincent B. Smith

The establishment of the research and development division is an outgrowth of nine months' intensive work by the society's committee. Activites will be directed from a central office located at 330 West 42nd St., New York. The headquarters staff will use the reporting facilities of an established organization of *Engineering News-Record* field correspondents who will supply project reports on the progress of postwar construction.

Will issue inventories

The research staff will compile and issue comprehensive inventories for the guidance of public officials, industrialists, engineers and architects. These inventories will provide accurate information relating to the volume of private and public postwar construction planning in progress or completed in various sections of the country, classified as to types of projects. Reports also will be made available to newspapers and to all technical and business publications interested in such data, as well as to public and civic organizations and to the local sections of the Am. Soc. C. E.

The civil engineers' program is to be related to the planning activities of local units of the Committee for Economic Development, chambers of commerce, labor organizations and similar groups interested in postwar economic and construction planning.

By a special arrangement with the McGraw-Hill Publishing Co., the committee has had placed at its disposal the services of Mr. Smith and the field reporting facilities of *Engineering News-Record*. Mr. Smith who has been on the editorial staff of *Construction Methods* for the past 17 years is also postwar construction consultant to both this publication and *Engineering News-Record* magazine.

Mr. Owen's experience includes eight years as commissioner of public works and engineering for the city of Dearborn, Mich., followed by seven years with an equipment manufacturing firm for which he acted as manager of engineering sales in this country and in foreign fields. He is a past president of American Public Works Association, serving it with distinction.

Mark B. Owen

Postwar construction committee

The Am. Soc. C. E. committee on postwar construction is made up of the following members: G. Donald Kennedy, chairman, Washington, D. C.; A. J. Ackerman, Pittsburgh, Pa.; Dean G. Edwards, New York; Frederick H. Fowler, San Francisco; Hal Hale, Washington, D. C.; Charles T. Leeds, Los Angeles; Gustav J. Requardt, Baltimore; Frank T. Sheets, Chicago; Malcolm Pirnie, New York, ex officio, president of the society.

No more Seabee training at Camp Peary, Va.

Camp Peary, near Williamsburg, Va., where about 25,000 construction workers have been receiving basic training for service with the Navy's Seabees, is to be converted to a general service camp in July. Its specific use, the Navy says, is to be determined later. The Navy declined to make any statement as to what will be done with Camp Endicott, the advance Seabee training center, at Davisville, R. I.

In the absence of any comment by the Navy, it is not known whether or not the 16,000 men, recently sent to Camp Peary for basic training, will be sent to Camp Endicott for advance training, in accordance with past Navy custom. Even if they are, they will be the last contingent coming out of Camp Peary, so that there would seem to be no further use of Camp Endicott by the Seabees. Men have not been recruited for this branch of Navy service for several months.

Some of the early Seabees had their basic training in the old National Youth Administration camps. Then Camp Bradford, near Norfolk, Va., became their training center. On July, 1942, Camp Peary was opened, and probably between two-thirds and three-fourths of the Seabees quota of 262,000 men and 7,500 officers have gone through that camp.

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New appropriation of $115,000,000 for FWA

Congress has appropriated an additional $115,000,000 to the Federal Works Agency for community facilities, to be used as needed for construction projects, and for community facilities such as child care. This became effective with the President's signing of H. R. 4346. This amount will bring total appropriations to $430,000,000.

As of Feb. 29, a total of 2,925 construction projects had been approved by the President, to be built at an estimated total cost of $358,845,455, of which federal funds would cover $302,069,987 of the cost. Many of these are fully completed or substantially completed; others are not yet constructed.

Approximately $75,000,000 has been allotted to the FWA for water-supply systems, and $45,000,000 for sewer installations. Hospital and health center construction is taking $63,000,000; school construction $61,500,000; and construction for recreation $30,000,000.

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Billion authorized for advance Pacific bases

On April 4 President Roosevelt signed a measure authorizing the navy to spend more than a billion dollars building advance bases in the Pacific. The bill also provides $600,000,000 for shore facilities in the United States.

The President also signed legislation authorizing an increase of $30,000,000 in the amount the Public Roads Administration may spend to repair and reconstruct access and feeder roads in the vicinity of army plants and camps. The boost from $260,000,000 to $290,000,000 was to repair damaged roads.

Construction Communiques

Engineering News from the Battlefronts

Cape Gloucester—What is said to be the most valuable wooden span in the world is described by Staff Sergt. Donald A. Hallman, Sr. This 100-ft. bridge, built by Marine Corps Engineers on Cape Gloucester, New Britain, is made of mahogany and rosewood, with approaches of iron ore, says Sergt. Hallman. There are 17 pile bents, each driven 16 feet into the mud of a swamp river. Every pile is mahogany, one of the most valuable and enduring of woods. For trestles and decking, there is more mahogany, plus the equally valuable rosewood. The road approaches are surfaced with gravel blasted from a hill of iron, lava and clay.

The result is a bridge capable of supporting 50 tons and a surfacing equal to the best macadam.

The Admiralties — "Battle-hardened Navy Seabees," said Correspondent Jack Turcott in the New York *News*, are putting the finishing touches to Momote airfield on Los Negros Island in the Admiralties, which they helped to hold during a series of reckless counter-attacks by fanatical Jap infantrymen.

"Throwing down their tools, the Seabees grabbed guns and fought alongside American dismounted cavalrymen from dusk Friday to dawn Saturday.

"When the battle ended, the Seabees helped the cavalrymen bury 700 enemy dead and then returned to their job of repairing the Fifth Air Force's newest airdrome."

New Georgia—Vice Admiral Samuel M. Robinson, Chief of Procurement and Material in the executive office of the Secretary of the Navy, tells how Commander Wilfrid L. Painter, engineer, was decorated for constructing advance air bases in the Solomons. "This was done while New Georgia was still in Japanese hands. He explored the island and surveyed a site for an airfield in territory which was still held by the enemy. He was thus able to have all preliminary work completed by the time our troops moved in, so that they had fighter protection from the start. Within 11 days he had the field in shape for emergency landings, and within a month it could accommodate two fighter squadrons. This was a job that contributed greatly to the speedy conquest of the Solomons."

Bougainville—It is said by the manufacturers that the only difference between an M-4 tank and the crawler tractor that W. I. Robertson, MM1c, calmly drove through a hail of machine-gun fire the day the Marines landed on Bougainville is that an M-4 has guns. However, that didn't keep Robertson from being one of the busiest men on the beach, and as a result of his "Can Do" performance, he has been accorded high praise by his commanding officer for gallantry.

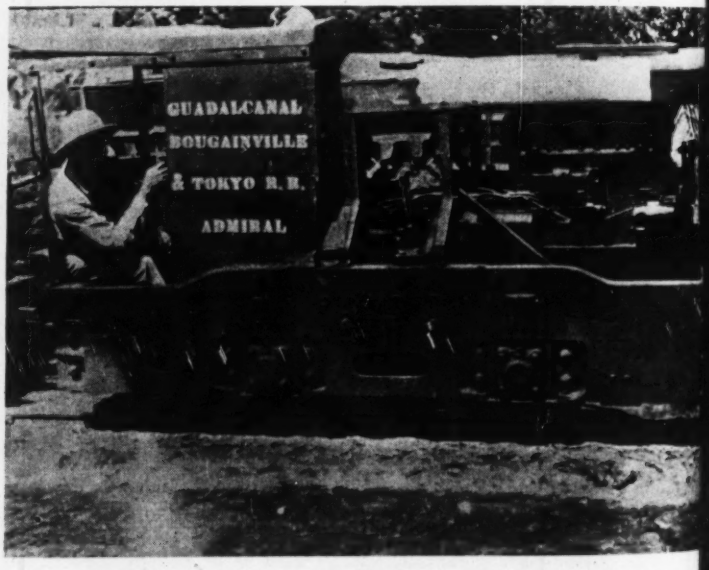
According to a story related to Marine Combat Correspondent Sgt. Bill Burnett, Seabee "cats" were on the beach within an hour after the Marines stepped ashore. They were supposed only to keep the beach cleared, sort supplies and keep rolling stock from getting stuck in the sand, but ammunition was running low with the fighting men moving inland, so the "cats" were given the job of dragging sleds loaded with shells up to the front, making their own roads through the jungles and swamps as they went. Drivers were forced to the ground by heavy fire many times during the operations.

Robertson says his "cat" still shows bullet marks on its blade and track [illegible] recalls that when night came and beachhead was secured the boys [illegible] the "cat" to knock over the Jap [illegible] boxes and cover up the dead.

North Africa — Breaking concr[illegible] digging "dead man holes" for foun[illegible] tion anchors, driving rivets, cutt[illegible] wood, and tamping earth are only a f[illegible] of the jobs performed for the Al[illegible] Army by "Madeline," an air compr[illegible] sor. This affectionately named equ[illegible] ment consists of a 4-cylinder gasol[illegible] engine, coupled to a 3-cylinder co[illegible] pressor, all mounted on a standa[illegible] GMC 2½-ton 6x6 Army truck. H[illegible] story is concerned with a platoon [illegible] 75 military roadroaders at Kasser[illegible] Pass in Tunisia, scene of some of the h[illegible] terest fighting in the North African ca[illegible] paign, which resulted in the elimina[illegible] of the Axis from Africa.

They were to rebuild bridges [illegible] stroyed by the retreating Germans. T[illegible] first work was a big bridge job. T[illegible] men took apart and moved for reass[illegible] bly elsewhere a 212-ft. 2-span, throu[illegible] truss railroad bridge badly battered [illegible] the Germans.

The lieutenant put his platoon on [illegible] 16-hr. schedule to utilize all daylig[illegible] hours. The men worked 8-hr. shif[illegible] but "Madeline" worked both shifts.



Seabees build a railroad on Guadalcanal

Completion of the Guadalcanal Division of "The Guadalcanal, Bougainville, and Tokyo Railroad," recently was marked by a "golden spike" ceremony reminiscent of the meeting of the transcontinental railroads at Promontory Point, Utah, in 1869. Seabees, who built "The G. B. & T." may have set a world record in railroad construction, for it took them just three days to finish the railroad, which is 1.22 miles long. It required [illegible] another two days to build a pier term[illegible]

Motive power for the G. B. & T. train provided by three gasoline-powered engi[illegible] One is named the "Admiral," the sec[illegible] the "Captain," and the third has yet acquire a cognomen. They are driven f[illegible] the right side of the cab by "engineers" the Army Service Command.

...lore steel permitted ...reinforced concrete

(Continued from page 53)

...ect to labor, transportation and ...lumber required in the erection of ...forced concrete buildings," Mr. ...ley said. "This will be accom...ed by increasing somewhat the ...unts of reinforcing steel which may ...tilized, since that material now is in ...e abundant supply than it was at the ... of the original issuance of Directive ... October of 1942. While it is esti...d that about 10 percent will be ...d in quantities of concrete, lumber ... labor, it is difficult to say what this ... mean in total quantities of material ...umber of persons employed because ...he uncertainties as to future con...ction and the amount of it which ... be in reinforced concrete."

Smaller projects exempt

...irective 8, relating to National ...rgency Specifications for the De... Fabrication and Erection of ...ctural Steel for Buildings, is ...nded to exempt from the emergency ...ifications construction projects re...ring 5 tons or less of structural steel. ...rwise, the necessity for a design cer...ate has been removed.

... Directive 29 the amendment makes ...cessary the submission of a certifi... of compliance with the National ...rgency Specifications for the De... Fabrication and Erection of Stress ...ed Lumber for Buildings.

...e amendments to these three di...ves have been developed as a result ...nferences begun in December, 1943. ...les on Directives 8, 9, and 29 ap...ed in *Engineering News-Record*, ... 17, 1942, Oct. 8, 1942, and Aug. ...1943, respectively.

• • •

...entucky Dam work ...alted by high water

...gh water on the Tennessee River ...d flooding, on March 31, of the ...ng cofferdam at Kentucky Dam ... Gilbertsville, Ky., to prevent its ... overtopped with ensuing greater ...ge. This cofferdam, one of the ...st ever constructed with circular ...pile cells 100 ft. high, was ...ribed in *ENR* Jan. 1, 1942, vol. ... 31, and Jan. 29, 1942, p. 195. ...n designed it was expected that it ...t be overtopped an average of once ...9 years.

...ooding of the cofferdam will further ... completion of this second largest ...ll TVA structures, on which work ...started in July, 1939. However, it ...is expected that power can be pro...d by fall.

JOBS OF THE WEEK

CEMENT PLANT, Leon, Mexico

Cementos Portland Del Bajio, Leon, awarded a contract for the construction of a cement plant to Leonard Construction Co., Inc., New York, N. Y. The estimated cost is $3,000,000.

ROCK JETTY and DREDGING, Seal Beach, Calif.

Guy F. Atkinson Co., Long Beach, has been awarded a contract by the Bureau of Yards & Docks, Navy Department, Washington, D. C., for rock jetty and dredging at $3,444,400. Graham, Anderson, Probst & White, Long Beach, are the engineers and architects. Leeds, Hill, Barnard & Jewett, Los Angeles, Calif. are the consulting engineers.

HOUSING PROJECT, New Orleans, La.

Public Housing Authority, New Orleans, La., awarded a contract for 47 buildings, with 500 housing units to Gravier & Harper, Alexandria at $1,826,555. Benson, Olschner & Spink, New Orleans, La., are the architects. This corrects report in March 2 ENR.

STOREHOUSES and FACILITIES, Barstow, Calif.

Bureau of Yards & Docks, Navy Department, Washington, D. C., received the lowest bid for four storehouses and facilities at Marine Corps Depot, from William Simpson Construction Co., Los Angeles, Calif. at $861,833.

STOREHOUSES, Oakland, Calif.

Bureau of Yards & Docks, Navy Department, Washington, D. C., awarded a contract for constructing five temporary storehouses, at Naval Supply Depot to Ford J. Twaits and Morrison-Knudsen, San Francisco, at $814,850.

CONSTRUCTING FACILITIES, Vancouver, Wash.

Maritime Commission, Washington, D. C., awarded a contract for the construction of facilities needed to build a floating drydock to Kaiser Co., Inc., Vancouver, Wash. Estimated cost is $2,279,000. Work on facilities will go ahead immediately, but the drydock, which is to be used by the Navy Department, will not be started until funds are made available by Congress.

ADDITIONAL HOUSING FACILITIES, Anacostia, D. C.

Bureau of Yards & Docks, Navy Department, Washington, D. C., awarded a contract for additional housing facilities to Ross Engineering Co., Washington, D. C., at $973,180.

RESIDENCES, Catonsville, Md.

Universal Housing and Development Co., Washington, D. C., will construct 250 residences by separate contracts. The estimated cost is $2,500,000. FHA approved.

CHEMICAL PLANT, Freeport, Tex.

Dow Chemical Co., Freeport, Tex., awarded a contract to build chemical plant expansion. The Austin Co., Houston will construct the plant at an estimated cost of $1,500,000.

ELECTRIC POWER UNIT, San Antonio, Texas.

City Public Service Board, San Antonio, Tex., awarded a contract for the construction of an electric power unit, including remodeling high pressure pumps, turbine, condenser, at power plant on Mission Road to Gibbs & Hill, Inc., New York, N. Y. The estimated cost is $2,000,000.

RUNWAYS, GRADING AT AIRPORT, Quincy, Ill.

Civil Aeronautics Administration, Chicago, Ill., received the lowest bid for three runways, drainage, seeding and grading at airport from Cheney-Wright, Williamston, Mich. The estimated cost is $1,500,000.

AIRPORT, Duluth, Minn.

W. Pierson, Dearborn, Mich., was the lowest bidder on crushed aggregate base course for extending two runways, grading, and paving airport when Civil Aeronautics Administration, Chicago, Ill., opened bids. On lean-mix concrete base course G. W. Haggart, Fargo, N. D. was the lowest bidder at $849,158.

Note—Additional bidding and contract news on many projects large and small appear in the Construction News section beginning on page 145.

OBITUARY

Alfred M. Quick, 77, an authority on the sterilization of water by chlorination and one of Baltimore's foremost engineers, died Mar. 31. During his administration as Baltimore city water engineer from 1900 to 1911, plans were drawn for enlarging the Loch Raven Dam and for building the filtration plant.

Harry E. Overstreet, 81, of Oak Park, Ill., a construction engineer and contractor who built the first sections of the Lake Street elevated railway and the Great Lakes Naval Training Station, Chicago, died Apr. 1. He was the owner of the Chicago Erecting Co., and among his construction projects were the first six naval air stations in the Caribbean area. He also built short-line railways in Tennessee and Iowa.

Willard W. Stone, 70, of Glen Cove, N. Y., died recently. A graduate of the Massachusetts Institute of Technology, he was with the Taunton, Mass., engineering department, 1893-1896; on the design of the Washington, D. C., sewer system, 1900-1902; resident engineer for New York State highway construction, Onondaga County, 1902-1906; assistant engineer with Board of Water Supply, New York City, 1906-1913; senior highway engineer, U. S. Office of Public Roads, 1913-1914; engineer New York State Highway Commision, 1914-1916; engineer for Portland Cement Association, 1916-1917; engineer at Federal Shipyard, N. J., 1917-1918; superintendent of construction for Snare & Triest Co., Raritan, N. J., arsenal, 1918-1920; and with county engineer, Department of Public Works, Nassau Co., N. Y., from 1923 till his death.

Olivier O. Lefebvre, 65 vice-chairman of the Quebec Streams Commission, died at Quebec on Mar. 25. Mr. Lefebvre was educated at l'Ecole Polytechnique. He was employed in the laboratories of the Federal Department of Public Works, later becoming assis to the Ottawa district engineer. In 19 he became chief engineer of the Que Stream Commission. One of his act ties was related to the regulation larger rivers for power production.

News of the Week
Continued on p. 102

CONTRACTS AND CAPITAL

CIVIL ENGINEERING construction volume in continental U. S. totals $33,963,000 for the week. This volume, not including the construction by military engineers abroad, American contracts outside the country, and shipbuilding, is 15 percent higher than in the preceding week, but is 64 percent below the volume for the corresponding 1943 week.

Public construction for the week is 36 percent higher than a week ago and is responsible for the increased total, as private construction is 23 percent lower. Compared with a year ago, however, public construction is down 68 percent, and private is 34 percent lower.

The current week's construction brings 1944 volume to $484,085,000 for the fourteen weeks of the period, a decrease of 51 percent from the $994,271,000 reported in 1943. Private construction, $106,186,000, is 2 percent under last year, and public construction, $377,899,000, is down 57 percent due to the 60 percent decrease in federal work and the 7 percent decline in state and municipal.

In the classified construction groups, gains over last week are in waterworks, sewerage, bridges, public buildings, earthwork and drainage, and unclassified construction. Increases over the 1943 week are in sewerage, bridg industrial buildings, and earthwork a drainage.

New capital for construction pu poses for the week totals $2,599,0 and is made up entirely of state a municipal bond sales.

CONTRACTS

Continental U. S. Only
(Thousand of Dollars)

	Week Ending Apr. 8 1943	Mar. 30 1944	Apr. 19
Federal	$76,090	$16,435	$23,2
State & Municipal	5,778	2,727	2,7
Total public	$81,868	$19,162	$26,1
Total private	11,973	10,250	7,9
TOTAL	$93,841	$29,412	$33,9
Cumulative 1944	(14 weeks)		$484,0
1943	(14 weeks)		$994,2

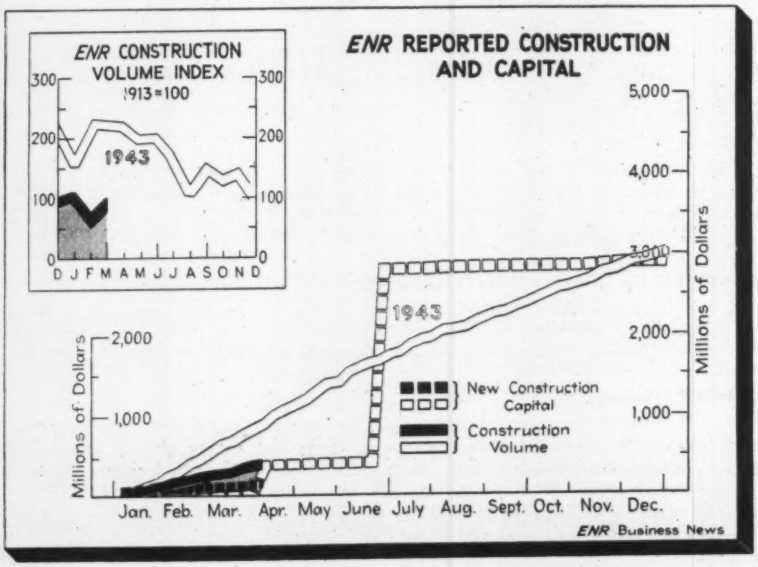
Note: Minimum size projects includ are: Waterworks and waterways projec $15,000; other public works, $25,000; i dustrial buildings, $40,000; other bui ings, $150,000.

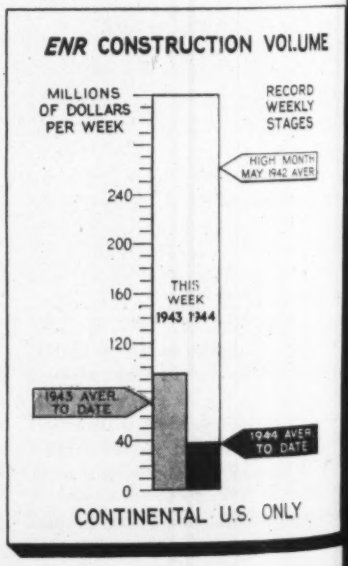
NEW PRODUCTIVE CAPITAL

	1943 14 weeks	Cumulative 194 14 we
NON-FEDERAL	$66,538	$93,4
Corp. Securities	2,250	33,1
State & Mun.	59,655	52,6
RFC Loans	1,500	7,2
FPHA Loans	3,133	
FEDERAL	$400,350	$90,5
TOTAL CAPITAL	$466,888	$184,2

ENR INDEX NUMBERS

Index base=100		1913	192
Construction Cost	Apr. '44	297.70	143.3
Building Cost	Apr. '44	234.50	126.7
Volume	Mar. '44	103.	45.


ENR CONSTRUCTION VOLUME INDEX
1913=100
1943
D J F M A M J J A S O N D
ENR REPORTED CONSTRUCTION AND CAPITAL
1943
New Construction Capital
Construction Volume
Millions of Dollars
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
ENR Business News



Comment and Discussion

Readers' opinions on matters that concern engineers and contractors

of Air-Entraining Cements Transit Mixers

ir: The brief summaries of t was said with respect to air- aining cements at the recent an- meeting of the American Con- e Institute, (ENR March 9, 1944 11) attribute to me a statement I did not make. In justice to the rter, let me say that I can readily erstand how he, not having my uscript, could misinterpret my ments as he did.

am credited with saying that e evidence is inadequate and con- ing with respect to whether air- aining cements should be used ransit mixers". The preceding is mbination of parts of two inde- dent statements which, when tied ther, make a good enough sen- e but misinterpret my thought. id "* * * * it might be reasoned a different amount of air-entrain- agent is needed for each type of ing unit and for each time of l. *If that is so*, the problems of crete control are multiplied many s and the use of interground air- aining agents becomes imprac- ble". I also said "We don't know answers to the many questions ented by this new problem, but know that the evidence on them nadequate and conflicting".

ll this is true but it does not add to the "whether air-entraining ents should be used in transit ers". It means only that doubt exist as to what precautions are essary in handling these special ents in such equipment—and, I ht add, the same doubts apply to r equipment.

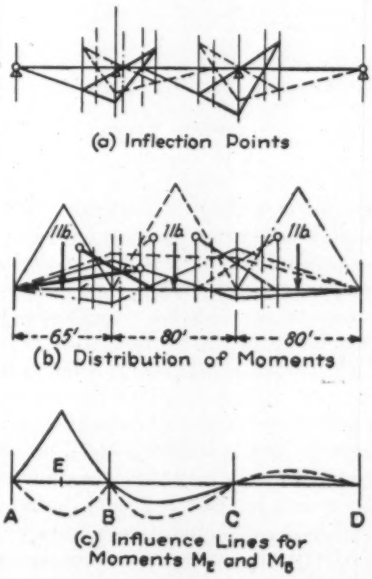
here is no question in my mind what air-entraining cements can sed successfully with transit mix- equipment. My personal experi- , and the experiences of numer- members of the industry attest hat fact. On the other hand, this essful use can be assured, with *ain cements*, only if it is under- d that special problems exist ch *may* require modifications in operating procedures. That is true of job-mixed concrete as well as of ready-mixed concrete.

Further I have confidence in the fact that the cement industry is well on the way to learning how to control the manufacture of air-entraining cements so that the special problems of handling so generally discussed at the Chicago meeting will either disappear or become greatly reduced in importance.

STANTON WALKER,
Director of Engineering,
National Ready Mixed Concrete Assn.
Washington, D. C.

Simplified Influence Lines

Sir: It has been correctly stated by C. J. Posey in his paper, "Computations for Influence Lines Simplified by Semi-graphical Method," published in *Engineering News-Record*, Dec. 16, 1943, p. 911, that at the present often it is required to construct influence



lines for moments in continuous beams of bridges. The method of construction of the influence lines presented by Mr. Posey has a considerable interest. In practice, however, the labor and time may be saved with the graphical construction of the influence lines. By the graphics the influence lines may be determined in the following three steps:

1. By construction of "three lines polygons," the inflection points on the continuous beam axis are determined, as shown in sketch *a* of the accompanying drawing. The elastic point at each support is at a distance of one-third span length measured from the one third point in the adjacent span.

2. With construction of "cross lines" through the central moments the bending moments diagrams for any position of unit load may be constructed sketch *b*.

3. With the ordinates measured from the bending moment diagram, sketch *b*, the influence lines for moments at any section along the beam axis may be constructed as shown in sketch *c*.

In the similar manner the influence lines for moments in haunched beams may be constructed. The constants for loading and elastic properties of haunched beams are given in the booklet entitled, "Analysis of Continuous Frames by Graphical Distribution of Moments," by A. A. Eremin, published by the author. Mention of this booklet appeared in the New Books section, *ENR*, Jan. 13, 1944, p. 58.—A. A. EREMIN, *Assoc. Bridge Engineer, California State Highways, Sacramento, Calif.*

Restrictions on Engineers

Sir: Recently I was reminded of a situation affecting the employment of engineers, which I feel deserves serious consideration now that we have begun to think of post-war activities. At a meeting in New York City I had occasion to introduce two engineers, one holding an important position with the city in an active department needing high-grade men, and the other a New Englander whom I understood would soon be in the market for a job. Knowing him to be an engineer of unusual ability I felt compelled to recommend him to the New York engineer. But I was reminded that non-residents were not generally eligible for civil service positions in New York.

Here is a man who has nothing to sell but engineering service, yet he is virtually prohibited from so doing because he is not a resident of a particular state. He could sell pumping equipment or fire extinguishers to

New York regardless of his residence, but not his own services as a public professional employee. However, if he happened to carry on a private engineering practice in Chicago or Boston he could be employed on the engineering design of municipal projects in New York City.

To give full credit to New York it should be stated that on rare occasions civil service appointments are granted to non-residents. This is more than can be said of my home state, Massachusetts, which requires in every case six months' residence for a civil service appointment.

It is my feeling that such restrictions to employment are unconstitutional, although I know of no instance where this question has been tested in the federal courts. It is not for an engineer to interpret the Constitution of the United States, but it is his privilege to read that document. Article IV, Section 2, states "The citizens of each state shall be entitled to all privileges and immunities of citizens in the several States." This sentiment is emphasized in the 14th Amendment, Section 1. "All persons born or naturalized in the United States, and subject to the jurisdiction thereof, are *citizens of the United States* and the state wherein they reside. No state shall make or enforce any law which shall abridge the privileges or immunities of *citizens of the United States;*—"

The problem of trade restrictions between states goes back to our early history. The danger of such restrictions are well-recognized, yet surveys which came to my notice some years ago indicated that these restrictions are still a serious problem. Certainly in the matter of engineering employment, restrictions of this kind should not stand unchallenged. Civil engineers, in particular, should take an active interest in this matter, since their full employment depends upon their ability to move from one section of the country to another.

During this war a great many engineers have been on the move, going from one state to another on the design and construction of war projects. Some have undoubtedly lost their resident status in their home states. When peace comes there is no telling where their services will be needed most. Yet because of the restrictions to employment in public service many of them will be unable to secure employment where their services can be used to the greatest advantage.

The cure for national isolationism might very well start by wiping out the state variety. Here is an opportunity for the engineer; if he succeeds in breaking down these restrictive civil service regulations, he will be doing a distinct service to all freedom-loving Americans.

SAMUEL M. ELLSWORTH,
Consulting Engineer,
Boston, Mass.

Iron Content

Sir: An inaccuracy occurred on p. 4 of the Nov. 25, 1943 issue of *Engineering News-Record.* In the "Letter from Latin America," the author, in discussing the iron ore in the Itabira mines, writes that the ore averages 68.5 percent ferric oxide. This would yield less than 50 percent pure iron.

As a matter of fact, Brazil's ore is practically all ferric oxide, and will yield some 68 percent of pure iron.

A. M. MORRIS
Barberton, Ohio

(The published statement should have read "68.5 percent *metallic iron,*" instead of ferric oxide; this would bring the text in line with Mr. Morris' comment.—Editors)

Erosion at Boulder Dam

Sir: The article "Erosion Causes Invert Break in Boulder Dam Spillway Tunnel" in *ENR,* Nov. 18, 1943, p. 762, is not only a challenge to hydraulic designers, as stated in your editorial of the same issue, but also a cause for every person, having anything to do with the planning and building of dams, to examine his attitude toward his duties, in order that he may remind himself of his responsibilities, no matter how small his part may be, and rededicate himself to the exercise of eternal vigilance against failure on his part to always perform his work with utmost care from the beginning to the very end of his duties on this very important type of construction.

Those who have had the opportunity to study the conditions first hand at the Boulder Dam spillway cannot state positively what caused them, much less can one do so from merely reading the article, although it does give an excellent report on the c ditions. Neither can it be said p tively that the conditions resu from any lack of skill or watchfu on the part of those responsible the design and construction.

The human element enters larg the planning and construction dams. As the rate of building and size of dams increase, the number human beings involved in such w is increased. The recruits that brought in to enlarge the ranks m not only be trained in the science dam building, but also be instil with the feeling that they have b selected for an especially import piece of work that requires more th ordinary care as well as ability.

This responsibility comes to the signer early in the development o project, but he should have the co dence that, after a plan has been proved and adopted, the construct will have the same care as he ex cised in the design. The man on t job can not relieve his conscience meet criticism as to the quality construction by saying, as has b heard, that it is good enough beca the designs have a large factor safety.

On a dam construction project t moves along in good shape every on the job with any character a spirit becomes interested in maki good progress, that is as it should but not at the expense of good wo manship, nor should it permit lowering of any of the guards agai flaws.

It takes strong character to keep high standards of construction to very end of a job, and it is easy to down as the work tapers off near t end. The high quality of inspection the beginning is sometimes lacking the end when some of the most imp tant features may be built.

The consultant on a dam proj may wonder about the quality of detail work on design and the de inspection on construction, but, cause of infrequent visits, he may that it is none of his responsibili Dare he feel that, if, in addition contributing the benefits from his periences and technical skill, he d not do all he can to instill in all w whom he comes in contact in the ganization the importance of con ual vigilance?

As the better sites for dams bec used, more difficult ones must be

red to meet the increasing needs water control. The size of dams is tinually increasing. Both of these and an increase rather than any rease in the quality of the charac- of the human element going into r design and construction. We can fit by the many improvements le in the technique in dam build- since the days of the pioneers in class dam construction, but we not lower the extreme care and the sense of responsibility that some hem had for their work.

Most of those holding the higher itions in dam building organiza- s today have a proper understand- of these responsibilities, but that erstanding may not always perme- down through the organization.

Somehow, every person connected the building of large dams, from consultant down to the rodman he line-and-grade party, should be le to know the importance of good nning and workmanship and his re- nsibility to help accomplish them.

C. C. CHAMBERS,
Tucson, Ariz.

inforcing in Walls

ir: Why should so much tempera- or shrinkage reinforcing steel sed in reinforced concrete walls? Quoting WPB-National Emergency cifications for the Design of Rein- ed Concrete Buildings—Art 712 : "Reinforced concrete walls shall reinforced with an area of steel each direction both vertical and izontal, at least equal to 0.0025 s the cross sectional area of the l, if of bars, and 0.0018 times the if of electrically welded wire ric."

et us consider a specific applica- of this paragraph. A concrete ement curtain wall spans between in. square concrete column piers. architectural reasons it is desired ake this wall the same thickness he column piers, namely 16 in. re is no vertical load on the wall, pt the dead load of the wall. Ac- ding to the code, this wall must e an A.=16x12x.0025=0.48 sq. or if placed in equal layers on face of the wall of 0.24 sq. in. ch gives us ½-in. dia. bars 10 in. centers in each direction at each . This wall except for archi- ural reasons could have been 8 in. and one layer of ½-in. dia. bars 10 in. on centers, in each direction, placed in the center of the wall.

Why is it necessary to place so much reinforcing steel in this wall? Some designers use ⅜-in. dia. bars 12 in. on centers both ways on both faces of wall, no matter what height of wall or thickness. These walls appear to be crack free.

The writer believes that this portion of the code should be investigated and that less steel could be used in most cases.

THEODORE B. RIGHTS,
Civil Engineer
Roselle, N. J.

Proportional Weir Work

Sir: It was interesting to read E. G. Smith's article "A Weir with Flow Proportional to Head" that appeared on p. 198 in your July 29, 1943, issue. Fig. 1 in the article is probably the simplest and most practical criterion that has been proposed for the design of proportional-flow weirs.

The curved sides of proportional-flow weirs of the type discussed by the author can be expressed by the equation

$$2\,x\,y^{1/2}=b \qquad (1)$$

in which x is measured from the vertical axis of symmetry for the symmetrical weir and the vertical side for the non-symmetrical weir; y is measured from a horizontal axis to which the curved sides would become asymptotic; and b is a constant. Equation 1 is recognized to have the same meaning as the author's relationship

$$W\,H^{1/2}=K \qquad (2)$$

In Fig. 1 of the article the head is measured from the weir crest. According to Equation 2 the width of notch approaches infinity as the head approaches zero. It follows, then, that the head datum and weir crest are identical and are coincident with the asymptote of the curved sides. Since it is impossible to have a notch base of infinite width, the author should indicate where and in what manner the curved sides of the notch are terminated in order for his Fig. 1 to be of maximum practical value.

It is interesting to recall that the basis for Equation 1 was developed in 1896 by O. V. P. Stout, of the University of Nebraska, and published in the 1897 Transactions of the Nebraska Engineering Society. During the same year an identical independent development was made by C. T. Johnston, assistant chief of the irrigation investigations of the U. S. Department of Agriculture, and, at a later date, by Joseph N. LeConte, of the University of California. Professor LeConte, the writer believes, is one of the first persons to formally recognize that the geometric shape of the weir crests fundamentally determines the exponent of the head in the discharge formula and can be analyzed for any given exponent. Apparently Professor Stout was the only one of the three early investigators to have actually constructed such a weir and put it into practical use in irrigation work. However, the writer has never learned the design that was adopted for establishing the base width and head datum.

The proportional-flow weir was not used to any great extent in those early years—in fact, it was apparently forgotten by most engineers because E. W. Rettger of the University of Cornell, presented the same development in *Engineering News*, July 25, 1914. Shortly after this article E. A. Pratt was prompted to publish the basis for the design of the Sutro proportional-flow weir in *Engineering News*, Aug. 27, 1914.

The writer believes the Rettger and Smith notches to be of the same type as that invented by Stout in 1896, and they probably differ only in the design adopted in establishing the base width and head datum. The author's approach to the design of a proportional-flow weir is excellent, and he can make a further contribution by detailing where and how the curved sides of his notch are terminated.

JAMES R. VILLEMONTE,
Lt (jg), USNR
West Coast Sound School,
San Diego, Calif.

Correction

Sir: I wish to call your attention to a typographical error in my article on "Bearing Pressures for Circular Plates" in the December 30th issue of *Engineering News-Record*. The formula for maximum bearing pressure should read:

$$p=\frac{Pc}{R^3}$$

instead of $\frac{Pc}{Rc}$

M. W. ROSENSTEIN,
Chicago, Ill.

EDITORIALS

VOLUME 132 NUMBER 14

April 6, 1944

Faith of the Engineer

IN THE HOPE that it might stimulate the maintenance of high ethical standards in the engineering profession, the Engineers Council for Professional Development has prepared an inspirational statement entitled "Faith of the Engineer". It is reproduced in this issue, copies of which printed on heavy paper suitable for framing may be had on application to this office. Most engineering societies have codes of ethics that are supposed to serve as guides to their members in matters of professional conduct. Generally, these are impersonal statements of fundamental principles, which are buried in manuals or yearbooks. The statement by the Engineers Council for Professional Development attempts to personalize those principles, giving them new significance. By publishing the "Faith of the Engineer" in a form that lends itself to display, the editors of *Engineering News-Record* hope to assist E.C.P.D. in broadening acceptance of the principles set forth by bringing the statement to the attention of many who otherwise would not see it.

Something New Has Been Added

MUSIC LOVERS EVERYWHERE are applauding the action of the sewage works operators of the Essex-Union County (N.J.) Joint Meeting, whose eight-man band made its debut at a recent meeting of the New Jersey Sewage Works Association, and then challenged any other plant in the country to produce a bigger or more harmonious aggregation. Not so appreciative, however, are municipal officials, who already visualize budget requests for violins, drums, trumpets and other potential music-making paraphernalia; as one apprehensive official put it, "With manpower, labor union and priorities troubles, haven't we already got enough discord?" However, the New Jersey innovation cannot be lightly dismissed. Quite properly, disturbed operators in the Chicago area may ask why a Sanitary District symphony orchestra is not being formed; on the West Coast fame probably would greet the appearance of a "Biofilter Five"; and the Coney Island chemical treatment plant could justifiably consider the adoption of "Limehouse Blues" as its theme song. In this connection it would be fitting for the formulators of an interstate compact on a certain big river in the Midwest to close their meetings with a rendition of "Beautiful Ohio". Just how far this musical business may go in the field of sanitation nobody knows. It would not be amiss, therefore, if consulting engineers planned for the employment of at least one orchestra arranger on their staffs. Definitely, something new has been added to sewage treatment operating practice.

Research Begets Research

THAT RESEARCH is a never-ending requirement was never better illustrated than by the present situation with respect to air-entraining agents in concrete. Studies extending back a decade or more have finally been climaxed by general agreement that entrained air increases concrete durability to freezing and thawing, and on this score is desirable, even though strength may be sacrificed. Now that we know this, however, we are confronted with many other questions, each requiring more research. For example, should the agent be introduced ground with the cement or added at the concrete mixer? Can we add the agent to improve durability and then add more cement to raise the strength? Are there agents that will entrain air and not reduce the strength? Does the type of mixing action, the time of mixing or subsequent agitation require different amounts of air-entraining agents. What effects do aggregate gradations and sizes have on air-entrainment techniques? Air-entraining admixtures are used here merely as an example of how effective research begets more research. Research is the mainspring of technical advance, and as such is one of our most potent postwar weapons. It should be embraced and supported more widely than ever before in the years that are directly ahead.

Maintenance by Contract

MAINTENANCE OF ILLINOIS highways by contract has proved to be so successful that it is being continued on an expanded scale during the war and is expected to become a permanent part of state highway operations. Begun as an emergency measure in 1942 when maintenance needs rose sharply due to inability to replace old pavements that were deteriorating rapidly under wartime overloads, the work includes patching old pavements, widening and resurfacing with bituminous mix-

ials. According to a paper on the subject by M. Hathaway, which is abstracted on page 66 this issue, the road contractors first approached subject of submitting bids on such work with ny misgivings as they had little to guide them determining what their costs would be. But by 43 all misgivings had disappeared. In that year number of bidders doubled. The significant ng about this development is that costs now are wn to the point where much of this work, which retofore was done with state highway depart- nt forces, probably will be done by contract after war. For the highway department this will an less seasonal expansion of its maintenance ces; and for the contracting industry, it will an a new field of activity.

rass Roots Engineering

ERYONE HOPES demobilization day will find this ntry's shelf of highway plans adequately cked, but many realize the actual number of mpleted plans for road and bridge construction y be all too few to launch a vigorous highway gram designed to keep abreast of the peacetime ge of traffic demands and, at the same time, pro- e full employment during the transition from r to peace. Digging into the grass roots of the uation, Samuel C. Hadden, president of the erican Association of State Highway Officials, proposed two of the most worthwhile schemes ered to date for creating a huge reserve of high- y construction projects for every state in the ntry.

Mr. Hadden's timely suggestions, made at the nual meeting of the American Road Builders sociation early this year were: (1) to widen thousands of miles of state highways already lt to approved grade and alignment but having fficient width for the safety of peacetime traffic, (2) to resurface existing roads damaged by essive wartime traffic loads, to provide pleasant safe riding qualities. "Neither of these types construction require extensive design plans", Mr. Hadden, "and the State of Indiana alone ld spend $12,000,000 for this very worthwhile hway improvement".

nstead of bemoaning the lack of sufficient engi- ring personnel to prepare an all-inclusive post- highway program, other state highway officials would do well to consider similar ways and means of building up their backlogs of projects for immediate postwar construction.

Strong State Department Needed

WHEN THE HOUSE Appropriations Committee of Congress recently cut the budget requests of the State Department, few civil engineers or construction men probably gave the matter a second thought, or even noticed it in the first place. Why should they? The problems of diplomats in striped trousers, morning coats and top hats would seem as far removed as possible from those of the world of construction. Yet, singularly enough, this viewpoint is a misconception, which can assume tragic proportions in the world of tomorrow if it is allowed to persist. Formal dress and brilliant banquets are merely the gaudy trimmings of a hard-working corps of specialists whose job, in addition to high diplomacy, is to lend a helping hand to all Americans abroad.

Engineers called to Russia or China will constantly need the counsel and aid that is available only from our embassies and consulates. The contractor who gets the great Middle East pipeline will be lost without frequent advice from these same sources. Airbase builders throughout the world will need to rely on the foreign representatives of our State Department when they get into difficulties with local authorities, and in Latin America, contractors will require guidance through the intricacies of fluctuating money exchange rates and complex labor regulations.

The peace setup that follows the war is bound to scatter American engineers and construction men all over the globe. A down-to-earth, efficient and strong State Department will be one of the most important factors in their success. Long accustomed to maintaining an interest in the troubles and problems of such federal departments as Interior, Labor, Agriculture and Commerce, the civil engineering—construction industry must now add those of the Department of State to its list. That is why it should be concerned when Congress fumbles a vital postwar decision, and restricts the planning and operations of the State Department at a time when its responsibilities, many of which concern the construction industry, are expanding enormously.

INEERING NEWS-RECORD WALDO G. BOWMAN, *Editor* **Copyright, 1944, by McGraw-Hill Publishing Company, Inc.**
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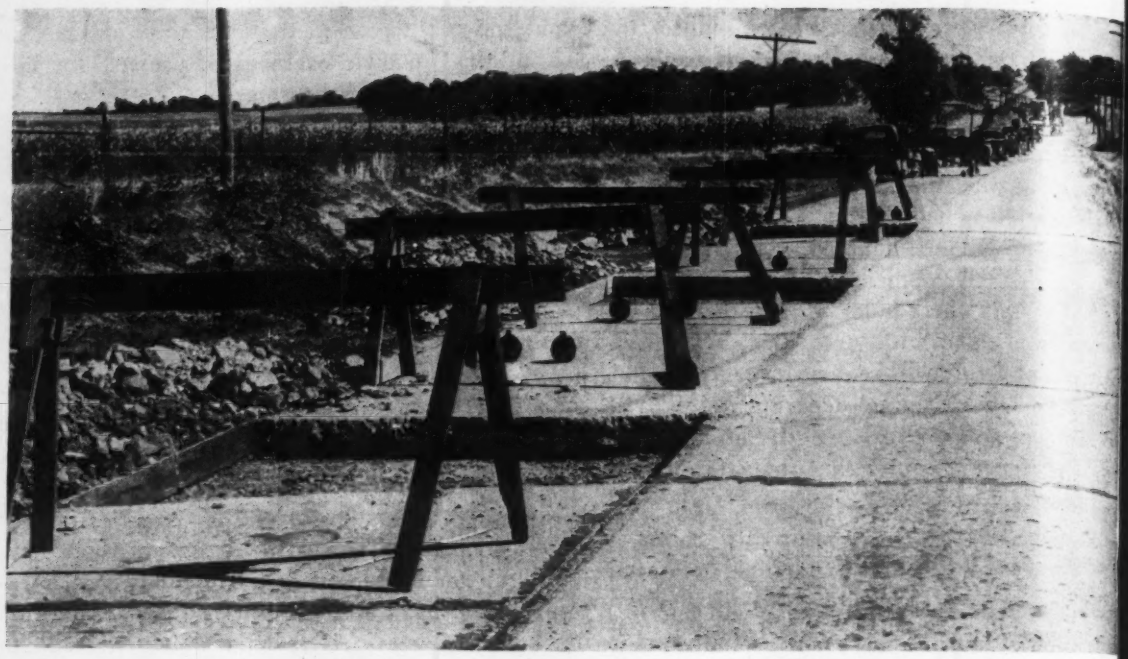

Fig. 1. Concrete patching prolongs the life of many miles of Illinois' highways subjected to abuse from wartime traffic

Illinois Contracts Highway Maintenance

C. M. Hathaway
Engineer of Construction, Illinois Division of Highways
Springfield, Ill.

***Contents in Brief**—Handicapped by a shortage of both maintenance personnel and equipment, yet faced with an ever increasing amount of pavement deterioration from excessive loads of wartime transportation, the Illinois Division of Highways has been pioneering in the field of highway maintenance by contract. Experiences encountered in concrete patching and bituminous resurfacing during the past two years were outlined in a paper presented by Mr. Hathaway at the recent meeting of the Associated Contractors of Missouri, in St. Louis, of which the following is an abstract.*

FOR SOME TIME following Pearl Harbor the general public, our military authorities and many highway engineers believed this country's vast highway system, then in good operating condition, would not require much maintenance or new construction since gas rationing was reducing the amount of traffic. The fallacy of this idea became quite evident in 1942 and last year it was driven home in a manner that was never anticipated.

It is true that passenger car traffic in Illinois was greatly reduced, but on the other hand, truck traffic has generally kept up. The real cause of excessive pavement deterioration on many strategic highways is, however, the operation of transportation units carrying loads far in excess of legal limits. Nevertheless, it is felt that this overloading must be tolerated for the duration since any other action would impede the prosecution of the war.

Temporary expedient

Perhaps Illinois pioneered a bit ahead of other states in forming a conclusion, early in 1942, that ordinary highway reconstruction program could cope with the existing situation. The program of highway patching and resurfacing finally adopted in the early spring of that year was not intended as a substitute for the necessary construction nor as similar programs recommended as such. It was the only logical thing that could be done and it was considered only as a temporary expedient. Both concrete and bituminous roads are included in the program.

Under normal traffic conditions it had been customary to patch cracks and corner breaks in concrete slabs with a bituminous mixture and to use concrete patches when failures were as frequent as five to ten to the mile. At the beginning of 1942 pavement destruction had reached a point where it was not uncommon to find such breaks running 50 to a mile and extending in length from 2 to 20 ft.

re and even on both sides of the ter line.

The development of a large mainte- nce organization to cope with this ation was entirely illogical both m the standpoint of personnel and ipment. Furthermore, a goodly mber of regular highway contrac- s did not care to undertake govern- nt work at that time or had not ob- ned it, and it seemed only logical to lize their organizations and equip- nt. Therefore, the patching work uired on Illinois' highways to- her with a certain amount of re- facing was grouped into conven- t sections and put up for contract ting.

While the expediency of this proce- re was viewed with some misgivings the department's engineers, there s even more doubt in the minds of contractors, especially in the mat- of economic procedure. Proof that h a program became very accept- e to contractors is borne out by fact that following completion of 1942 program the number of bids letting in 1943 was doubled—sig- ying a familiarity with construction ctice and keener competition.

Patching procedure

On concrete roads a careful survey each patching project is made as ly in the spring as possible and the posed patches are outlined in paint the information of the bidder and the future use of the resident engi- r. It was originally decided to use -ft. minimum length of patch, usu- y replacing the old concrete all the y from the center line to the pave- nt edge, but in 1943 a new type was igned for center breaks and outside ner breaks. Several schemes of it prices and length of patches were eloped at the beginning of the pro- m but in last year's work four ndard designs were employed.

The unit price bid per square yard patch included removing the old vement and all work incident to the cing of the patch. This worked out re satisfactorily since any effort to ke separate items only led to con- ion and unbalanced bid items. Un- ordinary circumstances it might ear unnecessary to classify the ching under four types, but this is ital problem to the contractor since length of patch is not directly pro- tional to the cost per square yard, ticularly as regards removal and mming of the old pavement.

In general the specifications were sufficiently flexible to permit the contractor to exercise his own ingenuity, with the primary requirements of the work conforming to required design and quality. Contractors standardized their construction practices to such a degree during 1942 that only a few new directional specifications were necessary last year.

Removal of old concrete

The breaking up and removal of old pavement utilizes a variety of equipment, but the method has now become fairly well standardized. The first step is to score a cut around the area to be repaired, using either a pneumatic pavement breaker or air hammer. This operation is kept to within 6 in. inside the painted lines to prevent harmful spalling and to allow ample space for squaring up the resulting edge of the old pavement. Next, the old pavement is broken up within that area by air hammers, pavement breakers, or drop hammers, depending upon the ingenuity of the contractor. However, due to impact transmitted to the adjacent pavement with resulting possible damage, the drop hammer is not now favored by the engineers. A heavy

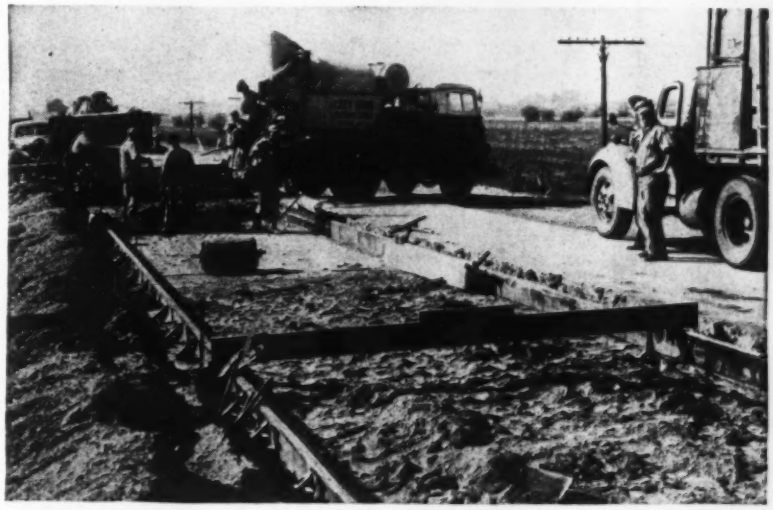

Fig 2. Poor subgrades are replaced with pit-run gravel, a transit-type concrete mixer minimizes interference to traffic, and finishing machines are employed on patches over 20 ft. long.

Fig. 3. Concrete patches, indicated by light-colored concrete, occur at frequent intervals. All joints and cracks are well sealed to prevent pavement pumping.

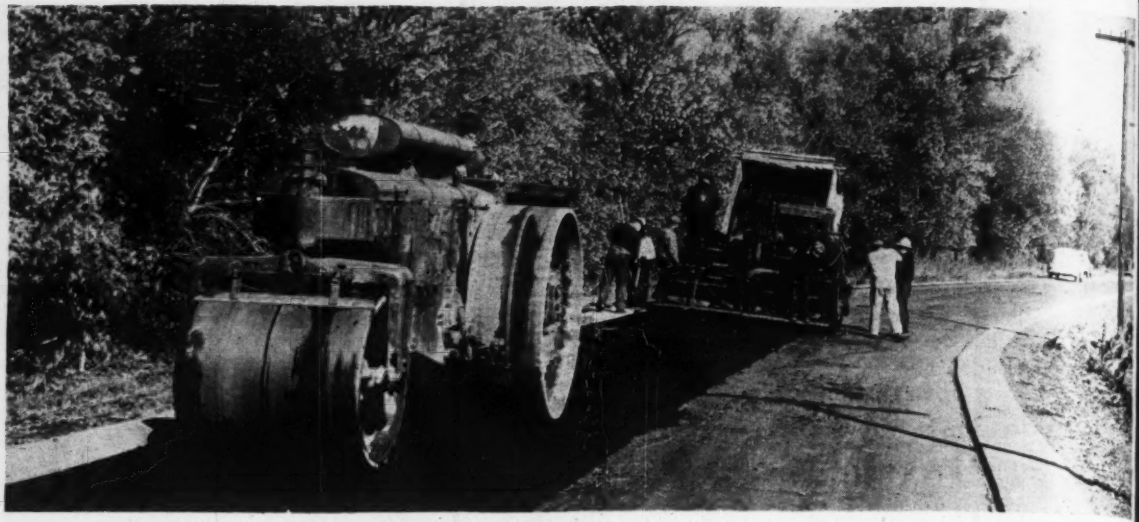

Fig. 4. A traveling finishing machine applies the hot-mix bituminous surfacing over one lane of the old concrete pavement.

sledge hammer proved the best and most economical method to square up the old pavement to a clean vertical face not more than 1½ in. out of line and with a minimum of spalling. At first thought this procedure might seem rather expensive, and if the usual machine tools were available an arrangement of multiple air drills could be developed which would make a direct cut, but for the duration this seems to be taboo. After all, one man with a sledge hammer can cover quite a bit of work in an hour.

Making the patch

A uniform 9- or 10-in. patch is employed with no attempt being made to match the thickness of the old pavement. Undercutting the old pavement was considered at first but it now is definitely out because of the danger of damage to the old pavement during construction and unequal subgrade stresses later on. As a rule, transverse edges are cut at right angles to the center line, although there is no objection to an angle of from 60 to 120 deg. with the center line. Experience has proven that transverse rods or any attempts to key new pavement with the old are not desirable. Hand finishing methods are satisfactory when the length of patch does not exceed 20 ft. Ordinary care must be taken regarding smoothness, particularly in matching the old pavement. Conventional water-curing methods were specified during 1942 but membranous curing was permitted throughout last year.

Poor subgrade, one of the basic factors of pavement failure was found in considerable quantity. Subgrade strengthening was not practical under short patches but for those of 50 ft. or greater, it was stabilized wherever necessary, particularly when replacing the full width of the pavement. Many side ditches were cleaned out or deepened, resulting in better subgrade conditions by lowering the water table, thus reducing pumping and breaking of pavement.

In order to speed up curing of the concrete, either a rich mix or high-early-strength cement was used, with the latter generally being employed. For mixing and placing the concrete, a transit-type mixer proved more efficient and caused less interference to traffic and construction than either a central mixing plant or paving machine. Concrete was vibrated along all edges and probably this will apply to the entire mass in the future.

Traffic protection

Handling traffic during patching operations is of paramount importance since it involves the safety and accommodation to the public. One lane of a two-lane pavement must be kept open while the work is under way and for four-lane highways, two lanes should be kept operable.

Barricades, lights and turnouts should receive due consideration by the contractors in preparing a bid as they are not trivial items.

This method of construction induces slower progress and introduces higher construction costs. Therefore, the proposition of maintaining one-way traffic versus arranging for a detour becomes one of economics and of determining just how far the state desires to go in the matter of service and safety for the traveling public.

Scope of program

In 1942 Illinois built 787,000 sq. yd. of concrete patching, at a total cost of $5,160,000. The 1943 program included 625,000 sq. yd. covering 1.93 mi. and costing $4,757,000.

The percentage of patching to total pavement covered in 1942 was 4.4 percent; in 1943 it was 2.9 percent. Cost figures for 1943 did not vary much from those of 1942, any increase being attributed to labor conditions. An average price of from $6.50 to $7.50 per sq. yd. prevailed for both years. The average cost per square yard for the entire mileage rehabilitated averaged $0.293 in 1942; in 1943 it averaged $0.23. The conclusion is that when patching runs less than 10 percent of the pavement involved, the cost figures are very stable.

After two years of this patching work by contract, the concensus of engineers and contractors alike is that it has been highly successful.

Bituminous resurfacing

The story of bituminous resurfacing presents few unique details, but here again the contract method was found preferable. This method of highway rehabilitation involves the placing of a hot-mix bituminous sur-

from 2 to 3-in. thick on concrete brick pavements that have reached stage of "beyond repair," to engthen them, eliminate surface ir-ularities and cover cracks and ches. This discussion does not er secondary bituminous resurfac- since only a nominal amount of h work was done by the Illinois ision of Highways.

The question frequently arises ere to draw the line between patch- of an old concrete pavement, re-facing with bituminous material or uilding with concrete. Obviously, last named is out for the duration. wever, there is a considerable mile- of old concrete pavement which le structurally sound nevertheless an unsatisfactory surface condi-n. Such roads can be economically rfaced with a bituminous mat ich should increase their life an imated ten years. In this class are ny of the older pavements where ffic has become relatively low. Such ds have become and will remain as ondary.

The second class of roads in this egory are those which will be re-aced in their entirety in a few years to poor grades and alignment. If y are structurally sound, not sub-t to the usual pumping action, and roads of medium traffic, their life be extended by resurfacing until onstruction becomes possible.

Present practice of resurfacing in-des the application of a 1½-in. der course and a 1-in. top course, ich is increased to 1½-in. where vy traffic justifies. A hot mix mate-l is applied on one lane at a time h a traveling finishing machine. hough it requires a rather costly mix plant the resulting product tifies the cost as compared with her a road mix or a traveling plant. ere were 207 mi. of this type of vement built in 1942 and 162 mi. in 3. Again it is safe to assume that h work will continue in 1944.

Secondary road maintenance

Another class of bituminous work h which Illinois has experimented he maintenance and seal coating of e secondary bituminous roads. Al-ugh this program has not been de-oped to any great extent, it is be-ed that when surface repairs are inal the seal coats can be applied contract as economically, in these es at least, as by maintenance forces. There are a large number of Illinois contractors who have the necessary tanks, distributors, and other suitable equipment, and who are in a much better position to meet the vicissitudes of the delivery of materials and consequent storage than are the small maintenance units.

Future outlook

The pioneer work in concrete patching and pavement resurfacing done in 1942 by Illinois received signal attention by the contracting organizations as it was appreciated that work of this character offered something new and worth looking into even though relatively small in amount. The amount of such work after the war may be only nominal as compared to the huge postwar program, but perhaps it is one of those side lines for the contractor that will help fill in and secure a well rounded yearly program. Furthermore, highway maintenance by contract may prove to be highly beneficial after the war since it would permit a reduction in the number of day-labor and special maintenance gangs which sometimes are unsatisfactory from the standpoint of a state highway department.

Fig. 5. Three inches of bituminous resurfacing, together with two feet of new concrete pavement along each side, modernizes this old 18-ft. pavement.

Fig. 6. Broken and depressed sections of old concrete indicate failure from excessive wheel loads. Such depressions are filled with an asphaltic binder prior to placing black-top surface.

Paints for Construction—II

Red-Lead for Structural Work

L. L. Carrick
Director, Red Lead Research
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***Contents in Brief**—The long recognized rust inhibitive qualities of red lead as a protective coat for structural steel can be put to the most efficient use through proper knowledge of the types of pigment and vehicles that should be combined for varying conditions of exposure. While red lead is primarily a primer pigment, there are advantages to be gained in using two or more primer coats under the top coat, which may be a lead-pigment paint. This is the second of a series of articles on points for use in the construction field. The first article appeared in the issue of Nov. 4, 1943, Vol. p. 682.*

WHEN ONE SPEAKS OF LEAD, either the metal itself or white lead, a paint pigment, invariably is called to mind by the civilian. White lead, basic lead carbonate, is only one of a number of industrial chemical compounds containing lead which are employed in the form of a fine powder in paint formulation for the protection and decoration of metal surfaces. As a matter of fact, the most important lead pigments employed in the protection of steel include not only red lead, but also basic lead chromate, blue basic lead sulfate, basic lead carbonate, basic lead sulfate, litharge, leaded zinc oxide, and to a lesser extent, chrome yellow.

The uses of lead pigments in paints are so numerous, that it is impossible to cover all applications in a single article, hence the present discussion will be limited to red-lead pigments in paint for structural steel, bridges, trestles, large storage tanks and the like.

Dependability of performance is the keynote for any paint. At best, a paint, unless especially formulated to meet a series of definite conditions can only strike a compromise. The durability desired is contingent upon the type of construction to be covered. As long as the paint film of a properly formulated paint is intact the anti-corrosion protection of the paint is at a maximum. Such films must have sufficient mechanical strength to resist the conditions of the existing exposure, be continuous, be practically chemically inert, must adhere and require little attention for long periods of time, and be relatively thin, 0.002 and 0.004 of an inch thick. Many steel structures have paint films of greater thickness, which have been built up over a period of years and afford excellent protection so long as the film retains its flexibility and is free from cracks. Such films owe their good characteristics to the selection of the proper primer paint as a foundation for the special environment.

The electrochemical nature of the primer coat and the paint system determine to a large extent its initial and continued adherence. The adherence of the film is influenced by the condition of the surface at the time of application of the prime coat, by its environment, by its internal physical changes, and by its chemical stability. If a paint system is properly formulated, it will have better mechanical strength due to minimized differences in the coefficient of expansion between coats, closer knitting of the

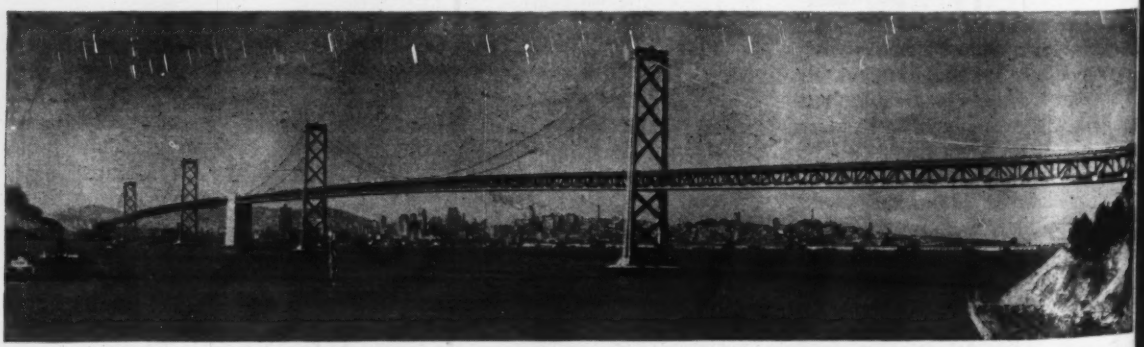


Fig. 1. Steel for the Bay Bridge at San Francisco was given a shop coat of red lead, a second coat of red lead tinted with black carbon, next a coat of black paint containing a substantial portion of red-lead pigment, and a finish coat of aluminum paint.

paint coats as a result of better adhesion and homogeneity and a reduction in intercoat electrochemical action.

Characteristics of red lead

Red lead, or minium, is the trilead tetroxide, Pb_3O_4, formed by the heating of litharge, PbO, at 900–950 deg. F., for several hours in the presence of an excess of air. Litharge, PbO, is an equimolecular compound of lead and oxygen, formed by igniting metallic lead or lead compounds in the air, usually yellow in color and soluble in fixed alkalies and most acids.

The percent of "true red lead," Pb_3O_4, is the basis for the principal commercial grades, as the 85, 95, 97 and 98 percent grade. The balance of commercial red lead is litharge. The unoxidized litharge associated with the red-lead particles reacts with acids and the reaction products combined with some organic acids are used as driers in paints and varnish. The specific gravity is between 8.0–9.0. The color is not stable in the air, since in the presence of moisture and carbon dioxide it develops a white bloom of basic lead carbonate which imparts to it a pink or white appearance. This change in color in no wise detracts from the value of the pigment.

Likewise when the vehicle of a red-lead paint weathers in the atmosphere, it exposes the red-lead particles to the moisture and carbon dioxide in the air and the red-lead particles, thus exposed, develops a white surface film of basic lead carbonate. This surface film is desirable in red-lead paint since by its formation, the paint film develops "tooth" or the necessary anchorage for the subsequent coats of paint.

While the 85 percent red-lead pigment is not stable in ready-mixed paint, yet the reaction products, lead soaps, are desirable in the paint film, as they impart greater hardness to red-linseed oil films than may be obtained by the use of the higher grades of red lead.

To utilize the desirable characteristics imparted to a paint film, the 85 percent grade red lead should be mixed on the job and only sufficient should be mixed to meet each day's requirements. These paints usually weigh 25 to 28 lb. to the gallon, depending upon the special condition of exposure under which the paint is required to function. Films of these paints have excellent rust-inhibiting characteristics and are durable on steel construction.

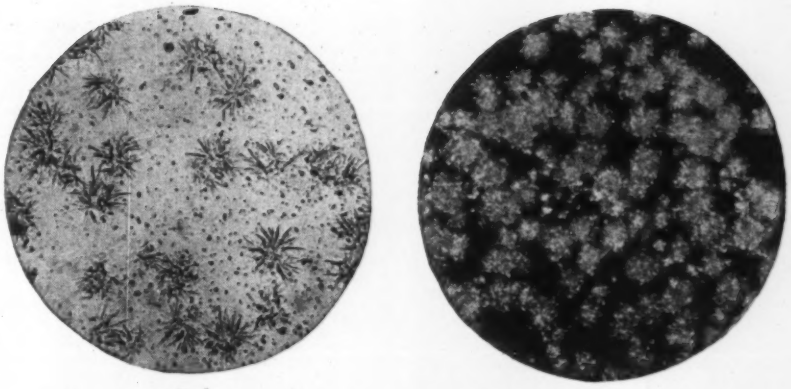


Fig. 2. The microscopic slide at the left, photographed by transmitted light, illustrates an early stage in lead-soap formation that is observed with red lead in raw linseed oil. The red lead aggregates form nuclei from which radiate sharp pointed rod-like transparent crystals of lead soap. The opaque masses are aggregates of molecules of red lead. At the right, a photograph by polarized light shows the crystalized character and the interlocking of the fan-like lead-soap formations which take place in red-lead pigmented paint films.

Quick drying vehicles

The 95 percent grade of red lead forms the base pigment in many paints which have a quick-drying varnish vehicle. Quick-drying varnish paints made of this grade of red lead will dry to touch within 30 min. and be suitable for recoating in four to six hours. Although the paint film is hard, yet it is tough and elastic. It has excellent durability in the atmosphere, and is particularly resistant to fresh and salt-water submersion when applied to steel surfaces. These paints usually weigh less than 20 lb. per gallon.

A semi quick-drying red-lead paint has been developed which will dry tack-free in from four to six hours and may be recoated within 24 hours. Its rapid drying, its excellent brushing qualities and its flow, make it a favorite for coating steel structures which have many exposed corners, rivet heads and nuts.

Although it is designed for brush application, by proper reduction, it works as well for spray application. These paints usually weigh 21 to 22 lb. per gallon.

Fig. 3. A gasholder in St. Louis, built in 1925, originally given two coats of red-lead paint, has received spot and finish coating only twice in 18 years to keep the surface in perfect condition.

Ready-mixed paints

A stable ready-mixed red lead-linseed oil paint is prepared from the 97 or 98 percent grades of red lead, due to the small litharge content and also the fact that there is almost complete coverage of the litharge by the red lead particles.

This paint may not dry as hard as the red-lead paint prepared from the 85 percent grade of red lead, but it has many uses where greater flexibility is desired. It possesses the advantage of always being ready for use. If litharge is added to this ready-mixed paint on the job, it will dry as the 85 percent grade and have the same characteristics. This grade may be used with a quick-drying varnish but has little or no advantage

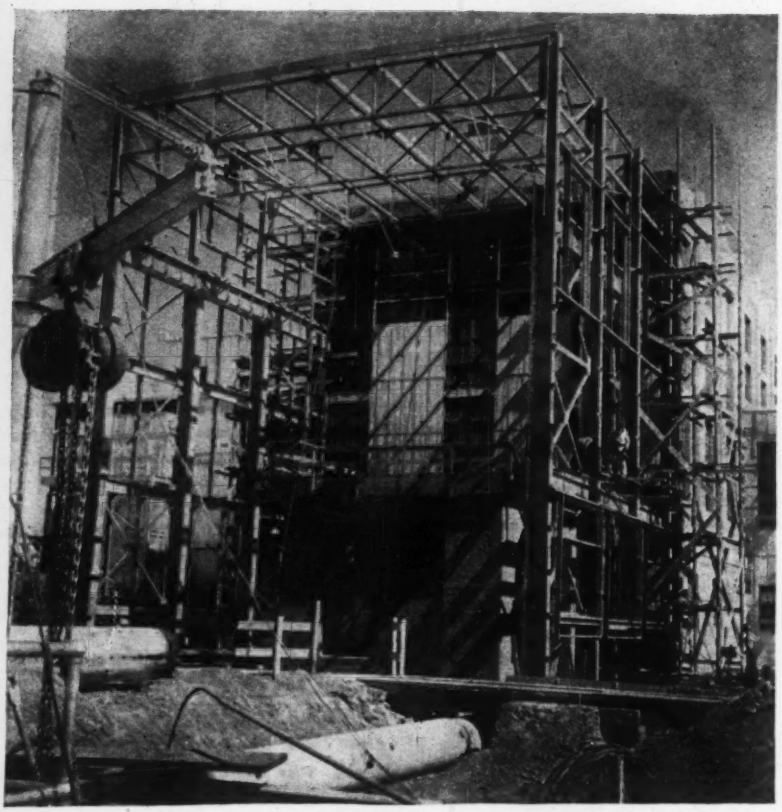


Fig. 4. Structural steel in this addition to the plant of the Central Arizona Light & Power Co. was painted with red lead according to Arizona state specifications.

over the 95 percent grade in this type of formulation.

Reduction of anodic action

Red lead has been the standard rust-inhibiting primer for over a century and has the best overall continuous primer record for steel either in carefully conducted tests or actual industrial practice. Red leads of high Pb_3O_4 content are stable in vehicles of linseed oil, and suitable vehicles based on phenolic resins or alkyd resins, or mixtures of them. Its alkaline nature reduces anodic solution of steel, its ability to form relatively insoluble soaps almost impervious to moisture, its oxidizing nature, and its ability to form a hard film all contribute to its extreme weather resistance with rust-inhibiting properties.

Red lead is primarily a primer pigment. Experience has shown that the application of more than one coat of primer paint increases the life of a paint system. In some instances as many as three primer coats are employed and have been found to represent sound painting practice. The primer coat or coats should be followed by one or more coats of some top-coat paint, especially designed to withstand the exposure conditions. The top coat may be a lead-pigment paint or some other water resistant ready-mixed paint.

Surface preparation of steel

The most important single factor affecting the life of paint on steel is the proper preparation of the surface before painting. The removal of rust and all the loose mill scale is imperative. This may be done by either mechanical or chemical means. Mechanical removal may be effectively accomplished by careful wire brushing, chip hammering, sandblasting, shotblasting, or flame cleaning. Chemical treatment may be accomplished by the application of a dilute aqueous phosphoric acid solution or ready-mixed surface treating preparations of this type which convert the rust to a well-anchored phosphate.

Before priming large steel objects, it is recommended that they be surface treated by either of the two methods suggested below. No matter which method is employed the maximum effectiveness of the primer is insured if the steel is painted while it is still warm from the final cleaning operation.

An entirely mechanical method consists of sandblasting the steel to remove the rust, mill scale and foreign matter, and following immediately by flame brushing to remove the moisture.

A combination of the mechanical and chemical surface treatment of steel surfaces for painting is accomplished by first, sandblasting, second, application of an inhibitor solution, and third, flame brushing.

The surface must also be dry, free from grease and foreign matter, and the painting should be done at as low a humidity as possible, preferably below 80 percent, and at a temperature above 50 deg. F. The paint should be well brushed into the surface. Any effort expended in approximating the ideal conditions will pay dividends in the form of longer service.

Atmospheric corrosion

The Iron and Steel Institute of Great Britain, in its 1941 report "Protective Painting of Structural Steel," states: "The following pigments are known to have inhibitive properties; red lead, white lead, lead chromate, blue lead (basic sulfate of lead), zinc chromate, and other sparingly soluble chromates, zinc dust and possibly zinc oxide. The committee's tests have shown that the most effective of these primers for general use is red lead and that chromate pigments are not on the whole quite so good: They give good protection in rural and marine atmospheres, but are inferior to red lead in industrial atmospheres."

It has been the practice of many manufacturers of industrial steel to shop coat their product before it is placed in the stockpile. The most outstanding corrosion inhibiting shop coat is red lead. The application of a shop coat of red lead-linseed oil to structural steel not only helps prevent corrosion but also increases the life of subsequent initial paint coats and its beneficial effect persists throughout the life of the structure.

Special industrial finishes use shop

s of rust-inhibitive pigments such red lead, white lead, blue lead, c lead chromate, with or without ous percentages of zinc oxide or ad and zinc chromate pigment, nd in a quick-drying varnish icle, which serves as a spraying dipping primer. These shop coats er dry in a relatively short time may be baked for a period so may be handled for immediate rication.

the fourth report of the corro- committee of the Iron and Steel itute of Great Britain, Special ort No. 13, p. 11, (1935), and firmed in the fifth report, (1943), stated, "As regards to the paints nselves, the priming coat should f an inhibitive character. So far paint tested by the committee has ed superior to red lead for this pose." Again on p. 62, under discussion on non-inhibitive and bitive primers, it is brought out "Red oxide appears to be the 'non-inhibitive primer', whilst he whole, in the case of inhibitive ing coats, red lead is better than chromate, which is about as d as the mixed red oxide and chromate paint." Red lead as rimer coat under other paints is tanding.

er anti-corrosion lead pigments

ed lead is not the only corrosion biting lead pigment. Less gen- y known, but good rust-inhibiting pigments such as blue basic lead te (blue lead) and basic lead mate (sometimes referred to as chromate) have chemical char- ristics, which, when applied to , neutralize the electrolyte which always be present when corro- occurs. The extreme fineness in icle size of these pigments en- them to fit into the irregulari- of steel surfaces and build up niform, coherent and water re- nt film, thereby protecting the from acid solutions, salt solu- , dissolved oxygen and other in the atmosphere.

hese lead pigments, when used primer coat, should be used next he bare metal. They may be with linseed oil, or varnish- vehicles. Any desired color or of paint may be used over primers. These paints may be as a top coat over red lead ers where the gray of the blue basic lead sulfate or the yellowish-red color of the basic lead chromate are desired.

Paint for bridges

Most of the railroad bridges today are constructed of steel which must be protected from moisture in any form and the gases in the atmosphere. The most critical coat in bridge painting is the primer coat. It has been the standard practice of engineers and maintenance men for a number of years to apply to all types of structures a first coat of red lead-linseed oil paint to reduce corrosion. Such practice is still sound, but for those installations where a shorter drying time is required, a quick-drying or semi-quick-drying red-lead paint is available.

Where time will permit, 28½ to 33 lb. of red lead per gallon of linseed oil is recommended for the first coat. The second coat should be of the same formulation except it should have one-eighth of a pint of lampblack paste added to each 100 lb. of soft-lead paste so as to be sure the first coat is completely covered.

It is common knowledge that red-lead paints function in direct proportion to the amount of red lead present. The red-lead paints which contain quick-drying varnish vehicles usually contain larger quantities of volatile thinner than the red lead-linseed oil paints but, nevertheless, good service is obtained where the ratio of the red lead to the non-volatile portion of the vehicle is retained. The top coat may be either a tinted red-lead paint, a lead-base paint, or some other water resistant paint. The

Fig. 5. Red-lead paint being applied to the nation's most famous bridge, the Brooklyn Bridge over the East River at New York.

quick-drying red-lead paint or the semi quick-drying red-lead paint are excellent steel bridge paints. These paints are also very useful in touch-up work.

The red lead paint has proven very desirable where long service is required, or repainting can not be done only at stated intervals.

A recent survey of the painting practice of the state highway department discloses that all except four of the states surveyed specify 100 percent red lead for the primer coat, while others find it advantageous to employ red lead extended with an inert extender. Several states require a shop coat of red lead which is followed by either one or two field coats of red-lead primer. Red-lead primer coats when followed by a s able topcoat give phenomenal serv

Typical examples of bridges p tected by red lead are the San Fr cisco-Oakland Bridge, Queensbor Bridge, Brooklyn Bridge and George Washington Bridge over Hudson River.

Red lead in railroad work

Railroads use red lead on a g variety of work involving steel r ing stock, water tanks and gen repair work.

In polluted railway-tunnel atm pheres, the sulphur fumes from coal smoke react with electroposi metals, which form with the moist in the air or water on the tunnel w soluble acid compounds. Metals el tropositive to iron or pigments ma from them, corrode more rapidly th uncoated steel and still more rapi than steel surfaces coated with lead primer paints. Well formul red lead is available to meet th conditions.

The role of red lead as an a corrosion agent also finds use steelwork of stadiums, hotels, o buildings, power stations, electri transmission towers and in subw

Interiors of water tanks

Red lead is used extensively the interior of water tanks. primer coats that are recommend by many municipal water dep ments and the New England W Works Association have a form tion of 10–1 red lead-litharge mi with linseed oil (32–35 lb. of red l to one gallon of oil). The mix of red lead-litharge with linseed done on the job due to the reacti of the litharge.

At least three coats of red-l primer should constitute the p system.

A quick-drying water resis varnish vehicle also is recommend and should be used for all coats. vehicle of this type dries harder th a vehicle composed of pure lins oil and therefore the litharge m not be added.

These factors should be taken i consideration in connection with location and climatic conditions a the quality of water used in the t

Tinting the second coat with la black is desirable in tank work wh the light may be poor to ins proper coverage.

SPECIFICATION CHART FOR STEEL CHARACTERISTIC RED-LEAD SPECIFICATIONS

Description	Used For	Pigments In The Paint
FEDERAL SPECIFICATIONS		
TT-P-86 and E-TT-P-86		
Ready-mixed paints	Structural metal primer	Red lead (97% grade).
TT-R-191a and E-TT-R-191a		
1. Dry pigment	Structural metal primer	Red lead (85%, 95%, or 97% grade).
2. Paste-in-oil	Structural metal primer	Red lead (95% or 97% grade).
CORPS OF ENGINEERS		
1. Military division, T-1601	Primer for rolled structural steel shapes.	Red lead (95% grade) and iron oxide.
2. Ohio River division, U. S. E. D., No. 512.	Metal primer	Red lead (95% grade), iron oxide, zinc yellow and extender
3. Construction division, CE-11	Exterior or interior, use TT-P-86 on structural steel and miscellaneous exterior metals.	Red lead (97% grade).
4. Olive drab enamel, glyceryl phthalate, T-1103D.	Enamel top coat	Red lead, lead chromate, zinc oxide, extender.
ORDNANCE DEPARTMENT		
Enamel quick-driving formula No. 3-181.	Rust-inhibiting enamel	Red lead, lead chromate, zinc oxide, extender (95% grade).
Enamel quick-drying formula No. ASX-904.	One coat system over phosphate-treated steel, as ammunition containers.	Red lead, lead chromate, zinc oxide, extender (95% grade).
TREASURY DEPARTMENT — PROCUREMENT DIVISION		
Formula No. 358 exterior, glyceryl phthalate marine.	Metal primer	Red lead (95% grade).
Formula No. 356 exterior, glyceryl phthalate marine.	Metal primer	Red lead, basic lead chromate, zinc oxide, and extender.
POST OFFICE DEPARTMENT		
Iron oxide metal primer	Metal primer	Red lead, iron oxide, zinc oxide and extender.
U. S. MARITIME COMMISSION		
MC-52-A-1 Class II	Red deck paint	Red lead and iron oxide.
52-MC-20	Ready-mixed primer for metal	Red lead (97% grade).
52-MC-18	Ready-mixed primer for metal	Red lead (97% grade), iron oxide, white lead carbonate and extender.
52-MC-23	Quick drying primer for metal	Red lead (97% grade) and extender.
MC-52-A-1 Class XXXIV, Red lead dry.	Metal primer	Red lead (97% grade).
AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS		
M-71-42 Dry or paste-in-oil	Metal primer coat	Red lead (97% grade).
M-72-42 Ready-mixed primer	Metal primer coat	Red lead (95% grade).
M-67-42 Ready-mixed paint	Green bridge paint, top coat	Red lead, chrome green, graphite and extender.
M-68-42 Ready-mixed paint	Black bridge paint, top coat	Red lead, iron oxide, graphite and extender.
UNITED STATES RAILROADS		
Pure red lead paint	Primer coat for: Coal cars, tank cars, steel cars, and exterior and interior of water tanks.	Red lead (97% grade).
Extended red lead paint	Primer coat for: Coal cars, tank cars and steel cars.	Red lead (97% grade) and extender.
Pure red lead paint	Metal primer for bridges	Red lead (95% grade).
Top coat paint	Top coat for bridges	Red lead and graphite or carbon black or lampblack.
Top coat paint	Top coat for bridges	Red lead, carbon or lampblack and black iron oxide.
TENNESSEE VALLEY AUTHORITY		
Standards No. C-44 ready-mixed quick drying paint.	Metal primer	Red lead (97% grade) and zinc chromate.
Standard No. C-47 dry red lead	Metal primer	Red lead (95% grade) and litharge.

For atmospheric exposures each ceeding coat of red lead paint uld be softer than the preceding t. This is accomplished by con- lling the amount of litharge added ach coat of paint. On the other d, for underwater exposure it is to reverse the procedure for ospheric exposure, namely, each ceeding coat is harder than the ceding paint coat.

Function of the litharge

The reasons for the superior per- mance of litharge-bearing red-lead ts are (1) litharge and linseed react readily to form lead soaps, ch radiate tentacles of lead soap ch interlock with tentacles adher- to adjacent particles of litharge, ive strength to the film (2) the seems to dry hard, but actually ains elastic. For exterior paints elasticity is desirable but under- r exposures require greater hard- . The lead soaps formed on the face of the litharge particles ab- some oil, thus through the oxi- on of the absorbed oil, hardening paint and making it more resistant water. The formation of lead erate in the film also imparts itional hardness to the film.

Postwar rust-inhibiting paints

he war has been a great clear- house to increase our technical wledge of the pigments and vehi- used in paint formulation. Rust- biting qualities of pigments have given a field test which promise affirm the use of certain standard t formulations, which have again stood the acid test of service. In tion, the most likely change will recognition of some new rust- biting formulations based upon ead which will furnish equal and rior protection when formulated eet special specification require- ts of low weight and cost per n. The red color of red lead can onger be used to identify red- paints. Red lead is tinted to h a variety of colors and at the time, retain the good charac- tics of a red, red-lead paint. The progress being made in the de- pment of quick-drying varnish les, and the red lead-mixed pig- ation paints which are just ging from the experimental stage ate a series of red-lead-base k-drying varnish paints which can compete with any paint product on the market and still retain the standards of red lead.

The emphasis will no longer be entirely focused upon speed or on providing a base for camouflage paint; emphasis will be upon a return to the sound policy of long service. Durability and special characteristics which emphasize a paint's suitability for a particular set of conditions coupled with a low maintenance cost will once again be uppermost in the minds of the consumer.

Straw Mulch Lays Dust Around a Desert Airfield

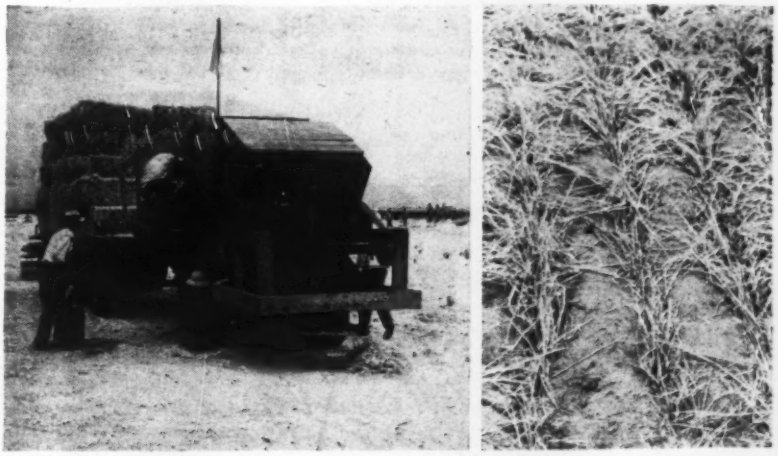
A mulch of straw, partly disked into the surface, has proved to be successful in controlling dust from the sandy wastes surrounding the runways of a desert airfield in an arid part of California. Low seasonal rainfall at the airfield precluded the use of grassing, spreading gravel over the surface was estimated to cost about eight times as much as the straw mulch, and soil stabilization using cut-back asphalt or similar oil stabilizer was estimated to cost six times as much as the straw. Also, the fine blow-sand at the site made oil stabilization difficult and the high temperatures and dry atmospheric conditions tend to break down the oil.

Straw for the mulching was shipped to the site in bales, various kinds of straw being used, and was spread over the surface with the straw spreader shown in one of the accompanying illustrations. The bales were loaded on a truck which was attached to the straw spreader, the whole assembly being pulled by a crawling tractor. Two men cut the wires from the bales and guided the straw into the spreading machine, the straw dropping at a 45 deg. angle onto a circular four-blade disk.

After the straw had been spread, a dull bladed disk harrow was run over it at right angles to the prevailing wind. The blades, being dull, did not cut the straw but pressed it into the surface in close rows.

Two tons of straw per acre were required. The cost of straw and the mulching operations amounted to $97 per acre.

Pioneers in this mulching operation for dust control were Capt. H. B. Sprague, A.A.F. liaison officer, Lt. Col. T. George Hazenbush, chief, Engineering Division "C", Pacific Division, and H. J. Cremer, division agronomist, Pacific Division. The work was carried out with approval of the district and division engineers of the Pacific Division.



Straw for the mulching was applied to the field with a spreader made from an old threshing machine. Right: Pressed into the surface with a dull bladed disk harrow, the straw forms a mulch that successfully keeps sand from being blown onto the airfield runways.

Water Supply and Sewerage Problems In Latin American Countries

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***Editor's Note**—Since 1942 the United States has been cooperating with Latin American countries in the promotion of health and sanitation activities through the Office of the Coordinator of Inter-American Affairs. Funds and top technical personnel for this work have been provided in large part by the United States, but each of the 18 participating countries also has made financial and personnel contributions in varying degree. Sanitary engineers and medical men, many assigned from our army, have been engaged on this work. Major Williamson herein summarizes data and observations that have served to guide the engineering aspects of the program.*

PROBLEMS OF WATER SUPPLY and sewerage in Latin America have assumed added significance in the western hemisphere during recent years. They will continue to grow in importance and magnitude as highways are opened and long distance air travel becomes commonplace after the war. And more rapid means of communication and travel will surely accentuate the danger of disease transmission.

Generally speaking, high mortality rates reflect poor sanitary conditions. Statistics and medical opinion indicate that intestinal diseases are one of the major causes of illness and death in Latin America, second only to malaria. In Table I is listed typhoid mortality rates for several countries south of the border and in the United States. The contrasting r in a general way provide a pic of the relative sanitary conditions prevail.

The number of persons dying f water-borne or sewage-transmi diseases each year in Latin Ame is exceptionally high, and this contributing cause to a lowerin the general economic status. In dition, persons who are afflicted disease, but recover, represent economic loss much greater in t than that reflected by deaths.

These data, however, should be viewed with caution, for vital stati are often inaccurate in some of Latin American countries. Howe in the case of death rates it may said that the figures given repre the lower limit, because some de are never reported.

TABLE I—TYPHOID MORTALITY RATES IN LATIN AMERICAN COUNTRIES
(From "Biostatistical and Epidemiological Report on the Americas"—Feb. 1943

Country and City	Deaths per 100,000 pop.	Year	Country and City	Deaths per 100,000 pop.	Year
BOLIVIA:			MEXICO:	42.5	1941
La Paz	193	1933	Mexico City	21.4	1941
COLOMBIA:	27.6	1940	NICARAGUA	9.3	1941
Bogota	22.0	1940	Nanagua	68.0	1939
COSTA RICA:	9.5	1940	PANAMA:	6.0	1931
San Jose	11.0	1939	Panama City	0.0	1938
CHILE:	14.3	1941	PARAGUAY:	15.0	1941
Santiago	17.5	1939	Asuncion	30.8	1941
ECUADOR:	13.7	1940	PERU:		
Quito	35.0	1938	Lima	12.8	1941
EL SALVADOR:	3.5	1941	DOMINICAN REPUBLIC:	11.0	1941
San Salvador	16.8	1942	Ciudad Trujillo	10.5	1941
U. S. A.:	0.8	1941	URUGUAY:	9.5	1939
Washington	0.4	1942	Montevideo	6.1	1941
GUATEMALA.	6.7	1940	VENEZUELA:	21.3	1940
Guatemala City	37.6	1940	Caracas	21.0	1941
HONDURAS:					
Tegucigalpa	27.5	1940			

Status of water supplies

As an outgrowth of a conferenc American foreign ministers held Rio de Janeiro in January, 194 division of health and sanitation established as part of the Institut Inter-American Affairs (a corpo entity of the Office of the Coordina of Inter-American Affairs). This d sion has been engaged in a coop tive program leading to the const tion of safe water supplies adequate sewerage facilities in ei een Latin American republics.

An overall picture of the statu water supplies may be gained f the following comments based on d assembled by the Coordinator's fice.

Standards of quality have not b extensively developed, but sev countries are guided by practices forth by the U. S. Public Hea Service. The absence of standard due, in part, to the lack of devel ment of the sanitary engineering p

ion in particular, and the inade-
cy of public health agencies in
eral.

Likewise, little control is exercised
r water supply design and opera-
by public health agencies. If this
e done, many potentially hazard-
features of design and plant main-
nce could be eliminated. This
in, however, hinges on the develop-
t of properly trained public
ith engineers. Many of the smaller
er supplies in Latin America could
made quite safe by a few simple
nges in design with a minor ex-
diture of funds.

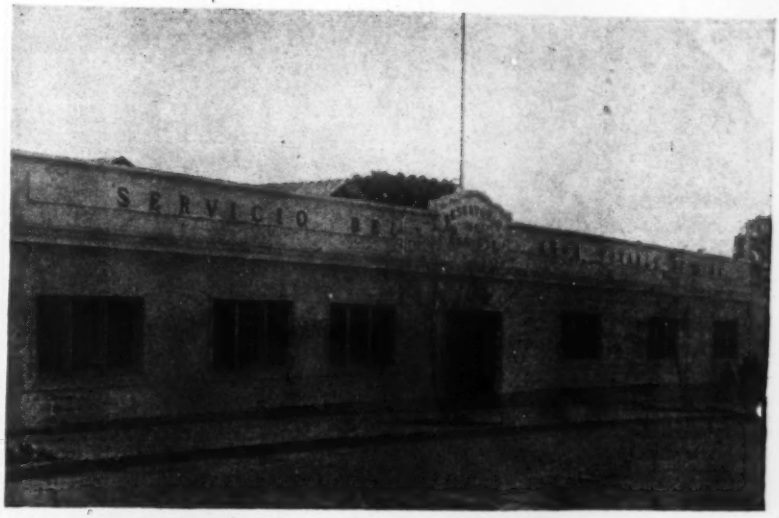
With the exception of a few well-
aged systems, bacteriological and
nical control which are necessary
e production of a safe water are
rally not used. For example, it
found that in one of the Central
rican republics only one water
em in the country made any at-
t whatsoever at bacteriological
ysis, and then only at quite irreg-
intervals.

Large cities lack systems

ne of the factors that may prevent
l development of adequate water
ly facilities in Latin America is
xistence of many large towns that
developed without a central
r system. This will mean a large
al outlay when a system is finally
tructed, and the expenditure re-
d is usually out of all proportion
isting property values. Had these
ms developed as the cities ex-
ed, the outlay would have been
ibuted over a long period rather
concentrated at one time as it
must be.

ogress toward safe water sup-
is being made in several coun-
as illustrated by the program
has been begun by Colombia.
940 the Colombian government
lished what is known as the
cipal Improvement Fund, which
pported by taxation, and is ear-
ed for construction of water and
age facilities, hospitals, and dis-
ries. After the first year of op-
n there were 154 water supply
2 sewerage projects under con-
ion. All construction work un-
is program is under the direct
vision of the department of
ry engineering in the Ministry
giene.

wever, the job to be undertaken
ombia is enormous, for in 1941



ENR staff photos

Fig. 1. Water supply contrasts in Peru. At the top is a covered storage reservoir in the capital city of Lima, which for many years has had a treatment plant. Below is shown the principal method for water supply in the small seacoast town of Chimbote; here the Coordinator's office is engaged in building a water plant and distribution system.

the Ministry of Hygiene reported that 556 municipalities out of 807 were without water supply systems. The report also states that of the 251 existing systems, 121 require complete reconstruction, 91 require extension, and 26 need general improvements. Thirteen cities with a total population of 800,000 are said to have satisfactory water supplies, but it was estimated that two-thirds of the urban population were without localities providing safe water.

Uruguay also has made excellent progress. Practically all of the major cities have adequate and safe water. Most of the large cities utilize treated surface waters, while generally the smaller towns are supplied from groundwater sources.

Poor distribution facilities

The feeders and distribution systems in Latin American water systems generally are too small to meet peak demands at reasonable pressures. Water for fire protection has never been of great importance, due to widespread use of a relatively fireproof type of construction, and the infrequent need for heating systems. Inadequate main size leads, in most cases, to periodic water shut-off and the installation of individual supple-

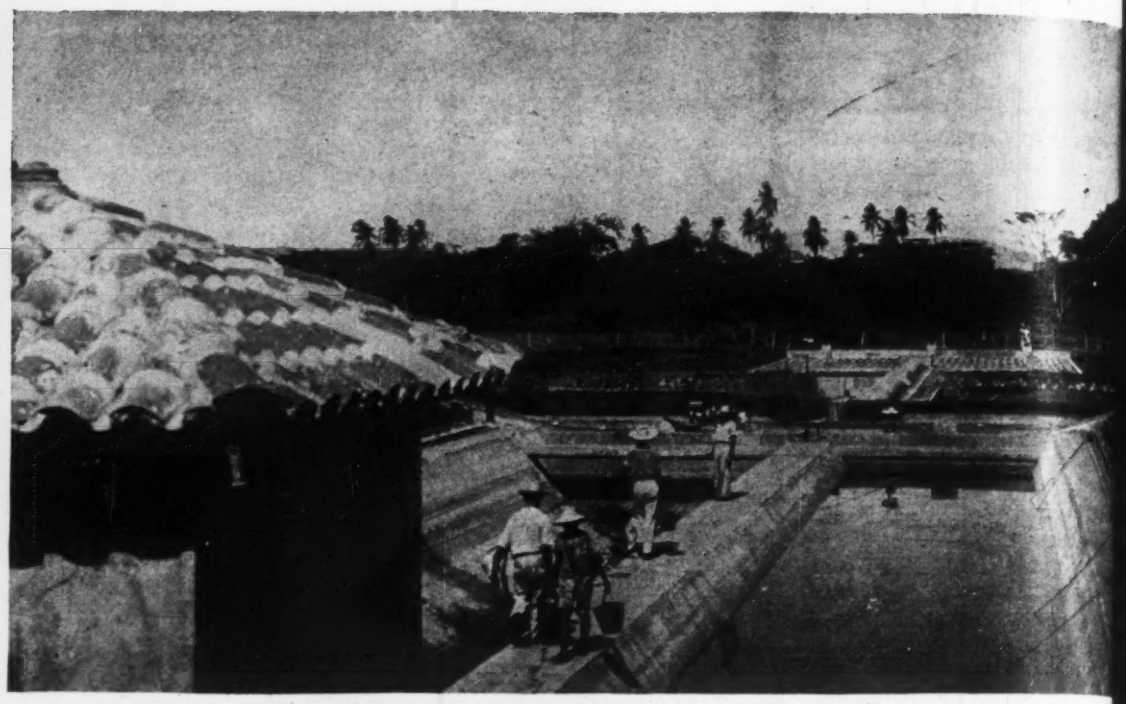


Fig. 2. Local materials featured the construction of this sewage treatment plant at San Miguel, El Salvador. This is one of the projects designed and built in the field by engineers of the Coordinator's Office. (See ENR Oct. 7, 1943, p. 528 for a complete description of the design, construction and operating feature of this plant).

mentary supplies. This in turn increases the possibility of contamination through back-siphonage. Also, many of the water supplies of Latin America are quite ancient. As would be expected, the aqueducts and distribution systems are in many cases in a very bad state of repair and so are subject to contamination.

An outstanding example of the plan providing water for only part of the day is to be found at Managua, Nicaragua, where the present supply is taken from Lake Asososca, a crater lake, relatively free of contamination and supplying water of good chemical quality. The pumping units are operated twenty-four hours a day, but even then it is only possible to supply water from 4 a.m. to 10 p.m.

While there are many safe water supplies in Latin America, the majority are still unsafe for human consumption. Generally speaking, relatively good sources of water supply are available and in many cases they can be made quite safe with a minimum of protection. However, with the exception of the major cities, treatment, even to the extent of chlorination, is not practiced; seldom does the distribution system carry a chlorine residual.

Recently, the shortage of chlorine cylinders has made the situation critical in those places where chlorination is practiced.

Sewerage development lags

A word now about sewerage facilities. As in the United States, the provision of sewerage must follow the construction of water systems. It is, therefore, not very far advanced. Data collected by one of our field parties indicated that only 45 percent of the principal towns and none of the smaller towns in that particular country had municipal sewers. In at least two of the eighteen republics there are no municipally operated sewer systems.

While there are one or two municipalities with systems that serve one hundred percent of the population, it can be said generally that most cities fall far below this figure. It is common practice for sewage to flow through open ditches in the most densely populated sections.

As has been the case in this country, several towns have sewer systems that were partly constructed but never completed. An example of the latter is the town of Manaos, Brazil, in the Amazon valley. Some thirty-four years ago a sewer system which, in the opinion of our engineers, was well planned, was constructed to s about one-third of the city, but outfall was ever built. A surve the situation indicated that at l part of the system could be pl in service with minor repairs and ditions.

Another practice that results in creased morbidity from intestinal fection is the use of untreated sew in crop fertilization and irrigat Sewage must be used for this purp in the arid regions of the wes coast of South America where w conservation is a problem, but practice should be eliminated to duce the incidence of intestinal ease outbreaks.

Generally speaking, while ther no great need for sewage treatm plants, sewer systems must be de oped before any outstanding impro ments can be made in municipal s tation. Designing engineers in the ture should be cautious in develo plans for treatment, as it has b the observation of our engineers the quality and quantity of wa will differ widely from those found the United States.

Status of the program

One of the best ways to impr health conditions in communities

provide a safe and adequate water ply. This fact was thoroughly preciated in planning the Insti- 's program. However, it was im- sible to emphasize water supply he general construction plans dur- the early months of the program. to the lack of local materials and critical nature of ocean shipping ng 1942 and early 1943.

Table II are listed the water ly projects that are now actually r construction or on which work been completed, but this data does give a true picture of the work mplished thus far. Many studies now under way which will reach construction stage in the near fu- Also, several countries have be- studies from which detailed plans specification will be provided for ous municipalities. It is hoped is manner to furnish progressive with a well-integrated plan for future.

nce local materials were more ily available for sewerage con- tion this has been a much more e part of the Institute program. projects on which work has be- have been listed in Table III. ere again, however, the entire pic- is not given in the statistics. As e case of water supply, there are y projects still in the preliminary y stage. Most of these will be tructed in the near future.

Engineers being trained

e of the most important projects g administered by the health and ation division of the Institute re- to the training of sanitary engi- and sanitarians in the United s. Some of these men are being ed in our universities and several been given travel fellowships.

e sanitary engineers undergoing ing are given courses, in addi- to other subjects, in water supply sewerage. Special emphasis is d on their obtaining the right of view for the work which they e expected to do when they re- to their native lands. It is quite tant that they understand and uppermost in their minds the e health aspect of design, opera- nd maintenance of water supply ewerage facilities. For this rea- it has been found advisable to ement their scholastic training field work given under guidance veral state health departments.

TABLE II—WATER SUPPLY PROJECTS SPONSORED BY THE INSTITUTE OF INTER-AMERICAN AFFAIRS

Country and City	Project Description
COSTA RICA:	
San Jose	Construction of slow sand filtration plant.
EL SALVADOR:	
San Salvador	Construction of distribution reservoirs, repair shop, and installation of chlorinators.
Zacatecoluca	Improvements to water system.
HONDURAS:	
Tegucigelpa	Covers for distribution reservoirs.
Comayaguela	Construction of slow sand filters
Comayagua	Improvement of water source and installation of feeder line to city.
NICARAGUA:	
Granada	Installation of chlorination facilities.
Masaya	Installation of chlorination facilities.
Leon	Installation of chlorination facilities.
MEXICO:	
Perote	Improvement of water source and construction of feeders and distribution system.
Huajuapan	Construction of infiltration gallery, feeders and distribution system.
PARAGUAY:	
Asuncion	Study of water problem. Institute of Inter-American Affairs will not construct this system.
PERU:	
Chimbote	Construction of wells and distribution system.

TABLE III—SEWERAGE PROJECTS SPONSORED BY THE INSTITUTE OF INTER-AMERICAN AFFAIRS

Country and City	Project Description
CHILE:	
Santiago	Engineering study for sewage disposal plant and sewer additions.
Villa Alemana	Construction of sewer system and complete treatment plant.
San Jose de Maipo	Construction of sewer system.
San Vincente de Tagua-Tagua	Construction of sewer system.
LaCalera	Construction of sewer system and primary treatment plant.
COLOMBIA:	
Barranquilla	Sewer extensions.
COSTA RICA:	
Heredia	Construction of sewer system and primary treatment plant.
ECUADOR:	
Quito	Sewer extensions.
EL SALVADOR:	
San Miguel	Sewer extensions and construction of treatment plant.
Santa Tecla	Construction of sewer system and primary treatment plant.
HONDURAS:	
San Pedro Sula	Sewer extensions.
Choluteca	Sewer extensions.
MEXICO:	
Parras	Construction of sewer system and primary treatment plant.
Tapachula	Construction of sewer system and provisions for chlorination.
PARAGUAY:	
Asuncion	Construction of sewer system.
PERU:	
Chimbote	Construction of sewer system.

At the present time, there are twenty sanitary engineers and eleven sanitarians undergoing training under the fellowship program. To date four sanitarians and one engineer have completed this training.

The problem of providing the necessary facilities in Latin America can only be solved in a long term program. In this respect the problem is akin to that in the United States where many towns still do not have water supplies, let alone sewer systems. A recent survey by the U. S. Public

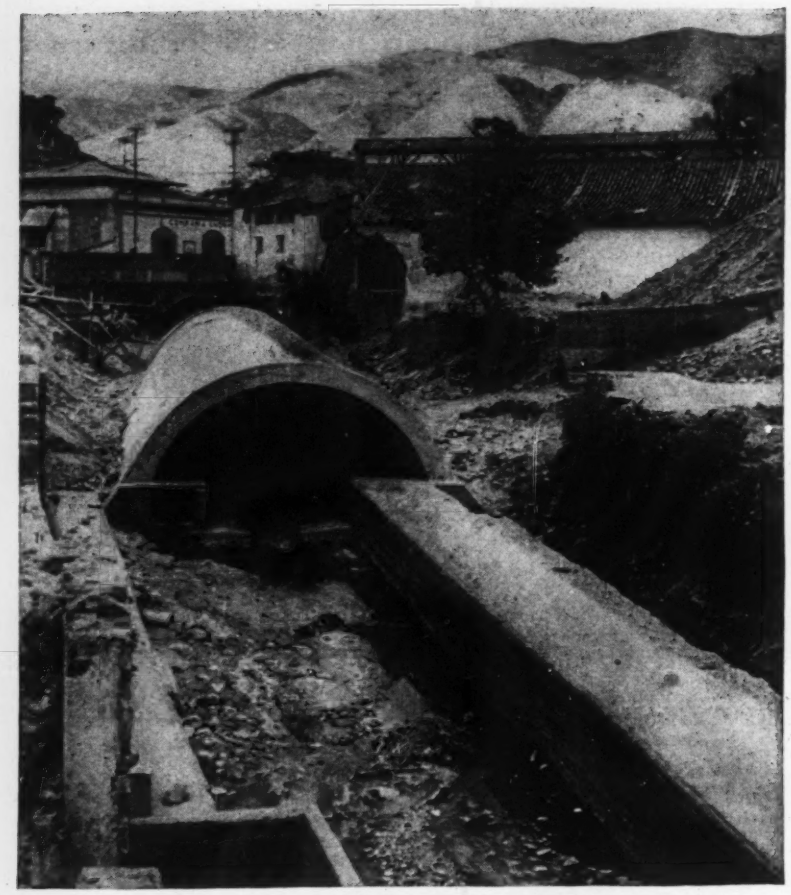


Fig. 3. Sewer construction in Caracas, Venezuela. Rehabilitation of a slum area of the city included placing a stream in a conduit, inside of which sanitary sewer drains were installed.

Health Service (see *ENR* Mar 23, 1944 p. 420) indicates that forty-three percent of the towns under one thousand population have no public water systems.

The engineering schools of this country can be of great service to Latin American nations if they instill visiting students with the necessity for correct evaluation of sanitary engineering works. All too often it is the tendency of the engineering profession to overdo treatment methods and to over-mechanize processes. It should be remembered that for the most part, simplicity of construction and operation should be the first consideration in designing Latin American systems and plants.

The writer was disturbed to hear a Latin American engineer engaged in public health activities say recently that sewage treatment was the outstanding problem facing our neighbors to the south. The need for sewage treatment, according to recent observations, is not generally important when viewed along with the need for adequate and safe water supplies and satisfactory means of sewage collection. Undoubtedly there are a few large towns which need sewage treatment plants, but their number is not comparable with the number which need first a good water supply. (see also *ENR* Oct. 7, 1943, p. 551, and *Sewage Works Journal*, Vol. 16, No. 1, Jan. 1944, p 121).

This discussion would not be complete without a word regarding the field engineering staff of the Division of Health and Sanitation. It has been through their efforts and ingenuity in design and construction methods that the program has been possible. All of the work listed has been under their immediate supervision and the entire credit for accomplishments should be given to them.

Health and sanitation activities in the Office of the Coordinator of Inter-American Affairs are under the direction of Col. A. R. Dreisbach, M.C., director of the division, and Lt. Col. H. B. Gotaas, Sn C. assistant director and chief engineer.

Technical Institutes Proposed in Canada

Establishment of technical institutes in Canada, under provincial auspices but possibly with federal support, was proposed by C. R. Young, dean of the faculty of applied science and engineering at the University of Toronto, at the annual meeting of the Engineering Institute of Canada. The purpose of these institutes would be to train men with technical aptitudes who either could not qualify for admission to a university or who could not afford the time and money required for such training. The institutes would give men without professional ambitions whose training needs are above the ordinary vocational level but less advanced than that offered by engineering colleges.

Dean Young said that consideration of technical education in Canada clearly indicates a serious gap in the above the secondary-school level and below that of the degree-granting engineering faculties. Technical institutes would serve the following types of young men:

(1) Those who have had industrial experience and have already chosen a vocation upon which they wish to embark with the least possible loss of time.

(2) Those who have passed the state of "book-mindedness" and whose mental learning processes center on actual doing rather than on formal study.

(3) Those who, for financial or other reasons, cannot devote four years to preparation for remunerative employment.

(4) Those who, having practical rather than intellectual interest, have had to leave college before progressing very far.

(5) Those whose educational qualifications would not admit them to a university.

Three types of training would be offered: Generalized engineering technology of a particular industry and functional training; courses probably would run for two years.

Ground Dewatering for Construction

Part 1—Background and Development of Procedures

Ross Nebolsine
President, Ranney Water Collector Corp., New York, N. Y.

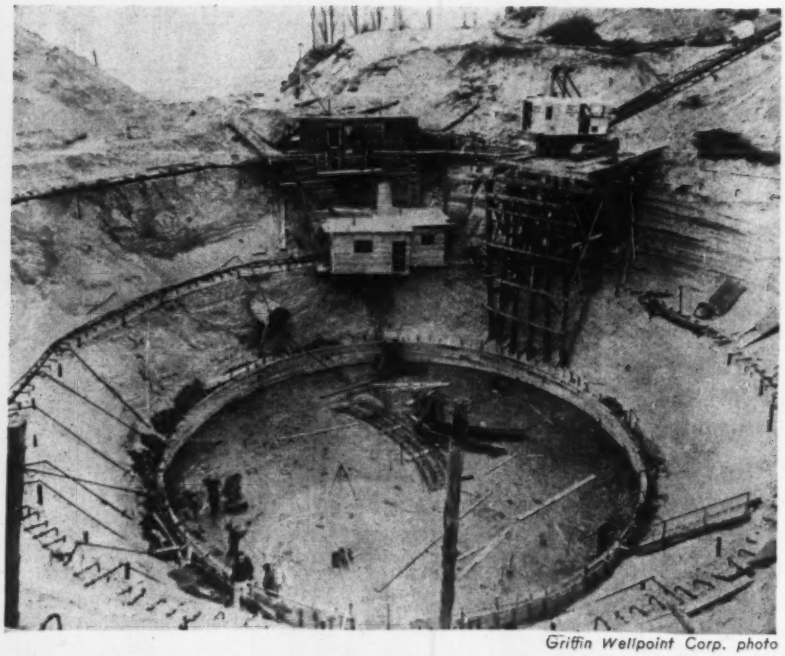
***ontents in Brief**—Development of the concepts and procedures for wering the level of groundwater to facilitate subsurface construction has olved within the last century. This article tells the history and describes ojects outstanding in the progress of subsurface dewatering. Part II, to pear in April 20 issue, will suggest a criteria for selection of drainage thods and describe the newly developed process for installing horizontal lls with description of its application to the Brooklyn-Battery vehicle nnel in New York.*

EWATERING of the unconsolidated ound for construction, as distinct m the draining or pumping of ter from structures in porous or fis- ed rock, dates back only to 1838. e collection and disposal of drain- e water was practiced in antiquity t the first record of reducing the ter table to facilitate construction ound in Robert Stephenson's "Re- port to the London and Westminster Water Co." dated 1841.

In boring the 2,442 yd. long Kilsby Tunnel on the London and Birmingham Railroad about 1839 great quantities of water and quicksand were encountered and Stephenson, as engineer for the railroad, found it necessary to sink 18 separate working shafts. Besides the working shafts other shafts were sunk for the purpose of draining the tunnel. Fig. 1, reproduced from a lithograph by J. C. Bourne, shows in the foreground the ponderous machinery for two of the pumps, which with others were worked by the same steam engine. A total of 1,800 gpm. was pumped for many months. Two work shafts may be seen in the background of the picture with hoisting done by horse power.

On this work Stephenson correctly observed that it was not necessary to pump down the water in the entire aquifer (water-bearing formation) but only "to establish and maintain a channel of comparatively dry sand in the immediate line of the intended tunnel, leaving the water heaped up on each side by the resistance which the sand offered to its descent to the

1. Dewatering of the Kilsby Tunnel in 1838 was done by wells to one side of the tunnel line, indicated by the head-frame.



Griffin Wellpoint Corp. photo

Fig. 2. Two levels of wellpoints, with a few pipes to a sump eliminate water and sheetpiling in an intake well more than 30 ft. below the surface of Lake Michigan.

line on which the pumps and shafts were situated."

The fundamental laws governing the movement of water through granular media were grasped by Stephenson, who further wrote: "The result of pumping at a deep shaft in porous material would be the drainage of a portion of the district represented by an inverted cone, the point being the bottom of the shaft, the upper surface, or what is generally designated the base of the cone, occupying an area depending on the inclination which the fluid assumed in passing through such porous mass. The inclination must vary with the character of the material. The resistance which the water encountered in its passage through the sand to the pumps would be accurately measured by the angle or inclination which the water assumed towards the pumps—it would be unnecessary to draw the whole of the water off from the quicksand—with no extent of pumping from any one point will the influence be apparent at any great distance."

Accurate deductions

These deductions of Stephenson's were remarkably accurate observations for that time, and their importance was not generally appreciated. It is probably safe to say that for almost a century no construction engineers surpassed Stephenson in the understanding of these phenomena.

Early German work

There was little advance in ground dewatering technique for more than fifty years. Starting with the subterranean drainage of Nollendorf Platz in 1896 in connection with the subway construction program in Berlin, the use of wellpoints and vertical wells for dewatering purposes was intensively developed in Germany. While there followed many examples of the use of wellpoints for open-cut work, for thirty years the use of deep wells for dewatering construction operations was impeded in Germany by the lack of suitable pumping equipment. For some reason the deep-well vertical turbine pump was not generally used, and a reliable submersible well pump was not perfected until 1925. In some instances lack of suitable pumps required sinking large-diameter wells to permit installing centrifugal pumps, within suction lift of the level to which the water table was to be reduced.

Wellpoints for dewatering construction projects first were used in the United States about 1900. The construction of the Gary Mill in Indiana a few years later is believed to have involved the earliest installation of large-scale systems of wellpoints for pre-drainage purposes. It was only after 1924, however, that numer improvements in wellpoint des methods of installation and pum equipment began to be develope

Predrainage, i.e., dewatering ground in advance according to a p prehensive plan to permit a cer procedure of construction, is a r paratively recent development. S eral construction projects will be c sidered in which ground dewater operations were of decisive imp tance, and these will serve to illust the various methods used. The p ticular cases have been selected the additional reason that most them represent the first large-scale plication of new procedures in particular country.

Bremerhaven docks

One of the earliest examples of use of numerous deep wells for gro dewatering purposes was at Brem haven, Germany. Prior to the ex sion of the harbor facilities in 19 31, some 479 test holes, many of th 12 in. dia., were sunk to determ the hydro-geological conditions of entire area. It was found that un about 50 ft. of soft clayey gro there was a stratum of sand aver ing 20 ft. thick, containing water der a slight artesian pressure. Be the sand was firm undisturbed cl Construction of two large harb locks and the extension of the graving dock required excavation the top of the water-bearing sand.

After an examination of the s samples, extensive pumping tests a some changes in the location of locks, it was found practical to p ceed with the project. Vertical we sunk to the sand stratum, were used reduce the head of water at each of two locks and at the site for extensi of the graving dock. The objective w to lower the piezometric level of t water in the sand by 50 ft., thus p mitting a submergence (depth in p meable strata below the required wa level) of about 20 ft. The wells w located outside the limits of the she piling to avoid interference with co struction.

In all, 58 wells equipped with s mersible pumps were used and 15 gpm. of water was handled. Confir ing the preliminary estimates, t radius of influence was found to 2,200 yd. When construction was co pleted, pumping was stopped and t water pressure in the sand was

wed to reestablish itself. Dewatering erations were planned and executed Siemens Baunion.

Rutgers St. tunnels

The first example in the United tes of the use of deep wells for de- tering the ground for a large con- uction project was on the Rutgers tunnels, built for the New York ard of Transportation in 1930-31. facilitate the construction of the ooklyn end of the twin 18-ft. dia. way tubes, which cross under the st River near Manhattan Bridge, unconsolidated ground overlying bedrock and consisting of medium d of glacial origin, was predrained a system of vertical wells. With El. being the mean high water datum, street level was 140 ft., the water le 90 ft., and the top of the rock 25 The subgrade of the construction ft was 65 ft, the invert of the tun- s at that point was about 75 ft. and tunnels were on a down grade ards the river, as shown in Fig. 3. Test borings revealed the presence a thin, impermeable and irregular mation at El. 30 to 35 ft. Below impermeable material was a stra- n of porous soil on top of the bed k. The piezometric level of this er aquifer was not greatly affected pumpings from the upper water- ring sand.

The objectives of the dewatering erations were to:

1) Sink the construction shaft under free air. All four tunnel shields were to be driven from this shaft.
2) Start all the tunnels under free air and eliminate if possible the need of compressed air in the land headings.
3) Reduce the air pressure in the river headings and in the deep underpining caissons required to support some of the approach piers of the Manhattan Bridge.

Five 100-ft. deep gravel-packed wells were sunk and equipped with electrically operated 500-gpm. vertical turbine well pumps. Four of the wells were located around the shaft, the fifth 200 ft. closer to the river. The wells each were equipped with 10-in. dia. screens about 25 ft. long.

The 30-ft. submergence available for the vertical wells was sufficient to drain the ground as planned and to permit driving each of the tubes, including the entire landward section, 1,350 ft. under free air. The cone of depression in the direction of the East River made it necessary to introduce air into the tunnels about 250 ft. riverward from the shaft.

The total pumping rate was about 1,500 gpm. It is interesting to note that the air pressure in the tunnels, as they approached the open river about 1,000 ft. from the shaft, was 6 psi. less than was theoretically computed from the head of the river level. As the shields reached the pier-head line, some 300 ft. beyond the water's edge, there was no noticeable effect of the pumping, and the air pressures in the tunnels reflected the mean river level. No effect of tides was observed.

The dewatering operations were planned and directed by Francis Donaldson, chief engineer of Mason and Hanger of New York, general contractors for the tubes. The wells were sunk by the Layne Co., also of New York.

Antwerp vehicular tunnel

One of the deepest large subaqueous tunnels in soft ground is the Antwerp (Holland) vehicle tunnel, which was driven under the Scheldt River in 1931-33 (*ENR*, June 29, 1933, p. 827). Wellpoints, deep wells and freezing were used to cope with groundwater. For the first time, dewatering wells were sunk in a river bed in connection with structures to be built under the river without the protection of cofferdams.

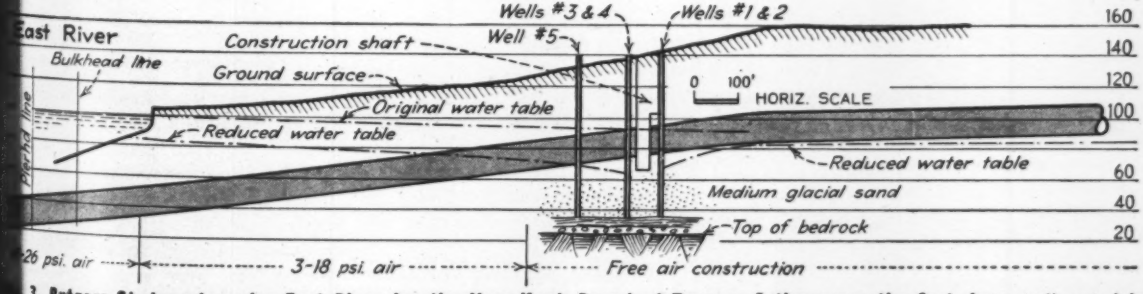
The tunnel is 5,800 ft. long and the subaqueous section of the tube, made up of cast-iron segments, is 30 ft. 10 in. in diameter. At the lowest point the bottom of this tunnel is 116 ft. below highwater. Water in the sand overlying a firm clay substratum constituted one of the important problems to be solved.

The ground encountered on the west side consisted of 25 ft. of silty sand, a 10-ft. layer of relatively impervious soil (which did not continue beyond the river center line) followed by 45 to 50 ft. of fine water-bearing sand. In places, near the top, the sand became coarser. The underlying material, found at a depth of 83 ft. below highwater, consisted of firm clay with a nearly level and quite regular surface. The ground on the east bank was similar, except that the surface material was fill directly over the sand, there being no impervious layer.

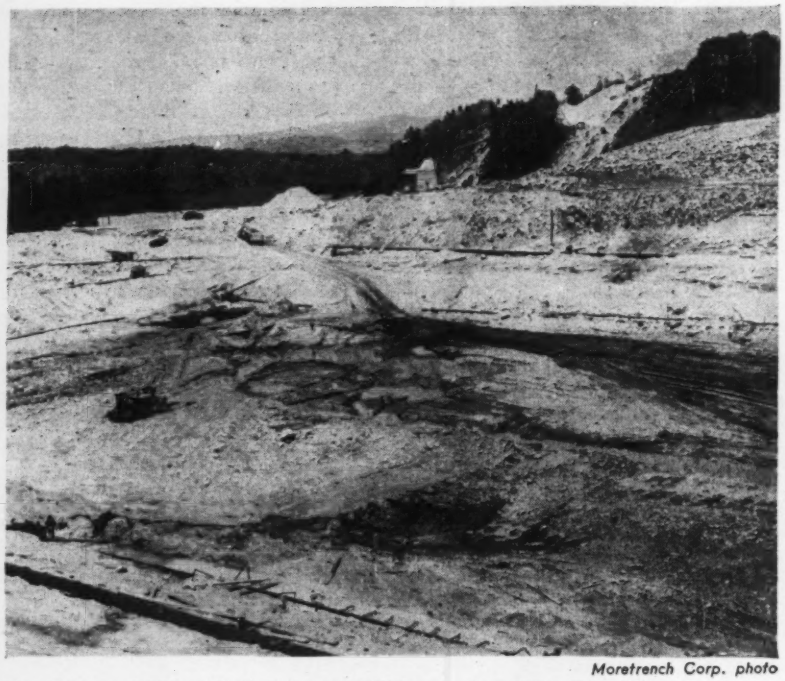
Tube mostly in sand

For most of the length of the tube the tunnel face was in sand or in sand in the upper part and clay in the lower. Only about 1,000 ft. of tunnel under the river bed had a full clay face.

The objective was to lower the water level in the sand as much as possible to facilitate the open-cut construction for the tunnel approaches and to reduce the air pressures required for the shield-driven section of the tube. First, wellpoints were used along and on either side of the west approach excavation. Below the impervious course, water was handled by a number of wells spaced at intervals of 15 to 60 ft., driven down to the massive clay bed lying about 92 ft. below the ground surface. The wells were gravel-packed, the outer casing being 20-in.



3. Rutgers St. tunnels under East River for the New York Board of Transportation were the first deep wells used in U. S. for dewatering a large construction project.



Moretrench Corp. photo

Fig. 4. Some 1,200 wellpoints took 14,000 gpm. from this silt and fine sand area at Franklin Falls Dam, N. H., to permit excavation in the dry by wheeled earth moving units.

dia. and the screens 10-in. dia. Submersible electrically driven pumps of 75-gpm. capacity were installed in each well. The groundwater level was lowered a total of about 45 ft. which, with the use of steel sheetpiling driven into the clay on either side of the tunnel, permitted building the 913-ft. long concrete section of the tunnel in open cut, as planned.

Groundwater lowered below river

Near the west bank of the river, a number of additional wells were sunk in two rows through the river bottom, about 50 ft. on each side of the tunnel line. By pumping these wells, in connection with those on the bank, the groundwater below the river bed was kept down to an extent that materially reduced the air pressure necessary behind the shield. Moreover, dewatering of the ground allowed the shield of the cast-iron section of the tunnel to be erected and driven far enough under free air to permit installation of all the tunnel construction equipment and the building of the bulkhead, including the man and materials locks. On the eastern landward section of the tunnel similar deep-well dewatering methods were used which permitted building, between two rows of sheetpiling, an 850-ft. section of the tube in open cut.

It is to be noted that because there was not sufficient submergence available for a drainage system consisting of vertical wells, it was not possible to obtain the full benefits of carrying out more of the work under free air. The numerous vertical wells were unable to lower the piezometric level of the groundwater, in the vicinity of the river and the two ventilation shafts, below a plane about 35 feet from the top of the clay. As a result, almost the entire cast-iron part of the tunnel had to be driven under compressed air and the ventilation shafts were equipped with air locks to permit the tube to be driven through them. To deal with the water pressure in sinking the two large ventilation shafts, the ground around each shaft was frozen by a system of 116 vertical wells through which refrigerated brine was circulated. In addition to overcoming groundwater difficulties, the necessity for bracing the ground was eliminated by the stability of the hollow frozen cylinder of sand, the walls of which were 12 to 15 ft. thick.

The consulting engineer for both the vehicle and the smaller pedestrian tunnel under the Scheldt was Ole Singstad. General contractor [illegible] the work was Pieux Franki of Li[illegible] On the vehicle tunnel, Pars[illegible] Klapp, Brinckerhoff & Douglas, [illegible] York, also acted as consulting en[illegible] neers. G. P. Nijhoff of The Hague [illegible] consultant on lowering the grou[illegible] water.

Extension of Southampton dock

In England, the first example [illegible] predrainage on an extensive scale [illegible] means of deep wells occurred in 19[illegible] 1933 in connection with the constru[illegible] tion of the King George V Grav[illegible] Dock by John Mowlem & Co. and E[illegible] mund Nuttall Sons & Co. Preliminar[illegible] investigations indicated the advisab[illegible] ity of reducing the artesian head [illegible] the sand seams in the massive clay fo[illegible] mation, located close to the bottom [illegible] the open excavation required for t[illegible] dock. Built of mass concrete, the do[illegible] was 1,200 ft. long and 135 ft. wi[illegible] with an overall depth of almost 70 [illegible]

Trial borings revealed the presen[illegible] of fairly fine water-bearing sand at [illegible] depth of about 100 ft., sloping dow[illegible] ward toward the outshore end. The i[illegible] dications were that for the landwa[illegible] two thirds of the dock there was a ris[illegible] that the water pressure would bur[illegible] through the overlying beds of cla[illegible] when the excavations for the walls an[illegible] floor were nearing their final depth[illegible] For the remaining one-third of th[illegible] length, the overlying thickness of cla[illegible] was judged to be of sufficient weigh[illegible] to overcome the water pressure.

Ten 24-in. dia. gravel-packed well[illegible] about 200 ft. apart and 175 ft. deep[illegible] were sunk to relieve the water pres[illegible] sure. There were five wells on eac[illegible] side of the dock connected to two di[illegible] charge lines. The lower sections of th[illegible] wells were equipped with 6-in. dia[illegible] copper filter pipes with narrow slots[illegible] which were surrounded by two con[illegible] centric cylinders of gravel. Electri[illegible] cally operated submersible pump[illegible] were installed in each well above th[illegible] copper screen pipes.

Water level lowered slowly

The water level was lowered abou[illegible] 100 ft. by starting one well pump afte[illegible] another over a period of several[illegible] months. After keeping the water tabl[illegible] down six months, during which the[illegible] bottom and side walls of the dock were[illegible] completed, the pumps were stopped[illegible] one by one over a period of eight[illegible] weeks and the water permitted to ris[illegible] slowly. In retrospect, it would seem[illegible]

t the importance of conducting all se operations very gradually was ggerated.

By connecting the wells to horizon- relief pipes leading into the dock ft. below the surface of the ground, water pressure under the dock is manently kept to 60 percent of its ginal intensity. Maximum pumping e was about 750 gpm. The natural through the horizontal relief es after completion of construction, en the water level in the dock was w the outlets, was 265 gpm. The inage system was designed by Dr. Willy Sichardt. Sir Henry Japp chief engineer for the contractors.

Wellpoints for an earth dam

Wellpoints have definite advantages certain locations, especially where area is accessible and where the er bearing formation is close to surface of the ground and to the tom of the open cut. Their use in plementing vertical wells on the werp tunnels was mentioned ve. On the upper Mississippi r locks, it is claimed that as much 0,000 gpm. was pumped by this hod from a construction site en- ed by sheetpiling.

se of wellpoints for dewatering a e area is illustrated by the method loyed for constructing the foun- ons for an earthfill dam at Frank- Falls, N. H.

ne of the operations was to re- e 10 to 15 ft. of river silt and fine

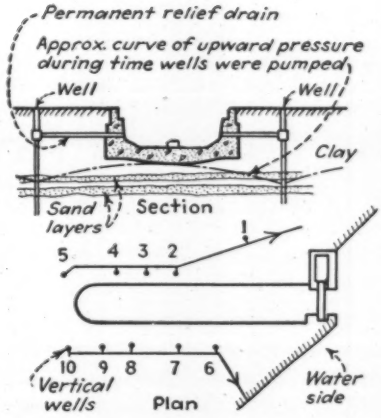


Fig. 5. Vertical wells were used for predrainage of sand seams below the King George V Dock in England.

sand from the bed of the stream prior to placing the rolled fill of selected material. Below this "wet" ground was a relatively impermeable strata which could not provide proper submergence for vertical wells. After diverting the stream flow, the entire river bed—an area 400 x 1,500 ft.—was unwatered by 1,200 wellpoints which surrounded the site.

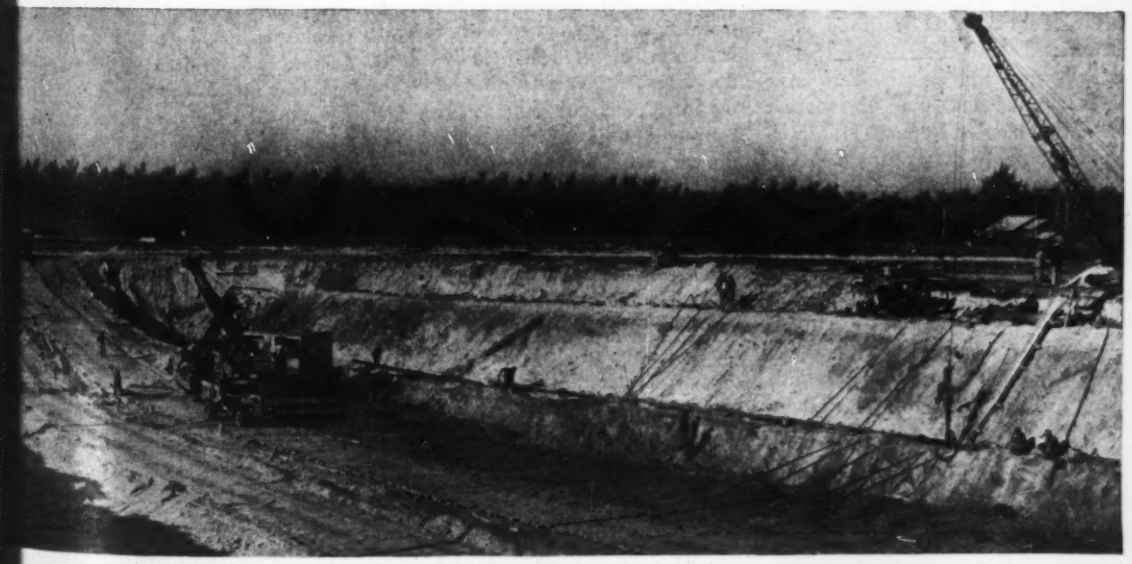
The water level was lowered from El. 297 to 280, thus permitting use of wheeled excavating equipment in the manner best suited for the particular conditions of the site. Prior to the drainage of the river bed under the main body of the dam, wellpoints were used to prepare the foundations on each side of the river and for the downstream toe of the dam.

Construction of Franklin Falls Dam was done by Coleman Bros. of Boston, Mass., and dewatering handled by Moretrench Corp. The work was under jurisdiction of the War Department, U. S. Engineer Office, Boston, Mass.

Cheaper permanent construction

Notable because the permanent structures can be of an entirely different and much less expensive type is the use of ground dewatering to prevent flotation of light-weight shipbuilding basins. At Tampa, Fla., wellpoints were used to unwater a series of three 83 x 1,200-ft. shipbuilding basins and one 82 x 520-ft. graving dock in marl over a pervious limestone. Two levels of wellpoints made excavation in the dry possible and the lower level of points is permanently maintained to keep the groundwater down. The basins are lined with only 8-in. thick concrete at the bottom and have thin, counterforted sidewalls. Weight of the basins is far less than that required to overcome buoyancy if the groundwater were not kept at a low level.

The work at Tampa is described in *ENR* July 15, 1943, p. 152. Other construction projects where wellpoints recently were used for dewatering are San Diego drydock for the Navy (*ENR* July 3, 1941, p. 39) and the Mobile vehicle tunnel (*ENR* Apr. 25, 1940, p. 572).



6. Two levels of wellpoints were used to dry out marl over permeable limestone rock in which the points were placed water a basin for ship construction at Tampa, Fla.

Railway Engineers Review War and Postwar Problems

***Contents in Brief**—Problems that the war has brought to engineers responsible for the maintenance of the track and structures of the railroads of this country were considered by the American Railway Engineering Association at a three-day meeting held in Chicago March 14-16. The sessions devoted to discussions of the manner in which the shortage of labor and scarcity of track materials are being met were reported in ENR March 23. Discussions of postwar problems are reported in the following. Also given are brief summaries of significant facts brought out in reports of the association's standing committees.*

THREE SUBJECTS DOMINATED the annual meeting of the American Railway Engineering Association in Chicago March 14-16. They were the growing shortage of labor with which to maintain railroad properties in the high state of efficiency that is demanded of them these days, the scarcity of materials required for that maintenance, and some of the broad general problems that will face the railroads between now and the end of the war and in the postwar period. Discussions of the problems relating to labor and materials were reported in the March 23 issue of *Engineering News-Record*, Vol. p. 389. Discussion of general problems now faced by railroad maintenance officers was inaugurated by J. M. Symes, vice president, Western Region, Pennsylvania Railroad, in a talk entitled "The Task Before Us."

Mr. Symes expressed concern over the failure of the War Production Board, the Office of Defense Transportation, and many high railroad executives to recognize the seriousness of the problems faced by officers charged with maintaining railway track and structures in a safe condition to carry the unprecedented traffic now being handled by the railroads. If these officers are to continue to maintain the railroads in serviceable condition, he added, their requirements must be met more completely than they have in the past.

Looking to the future, Mr. Symes said that the postwar world will require the fastest, safest, cheapest and most dependable transportation service that it is possible to produce. For the railroads, this means extensive rehabilitation and modernization of their systems and equipment. One way to insure the success of that program is to get young men into railroad service, especially into the engineering departments.

Attracting young men

Mr. Symes' thoughts concerning the importance of getting young men into railroad service came up for further discussion in connection with the report of the Committee on Cooperative Relations with the Universities. At that time E. M. Hastings, chief engineer of the Richmond, Fredericksburg & Potomac R. R., said that it is up to the railroads to formulate a cooperative plan with the universities for the training of returned soldiers for railroad service. Mr. Hastings added that the railroads also must establish training programs for other young men coming out of military service who do not want to go back to college. He laid special emphasis on the importance of such program to the railroads in order to keep new and able young men coming in at the bottom to replace the men lost by retirements and death.

According to one of the findings of the subcommittee, of which Mr. Hastings is chairman, most of such programs that were inaugurated in the years when many young men were going into railroad service have now been discontinued. The problem is further complicated by the fact that in many schools the teaching of railroad engineering has been eliminated or relegated to a position of [illegible] importance.

Similar views were expressed by E. Smith, vice president of the [illegible] Haven. Mr. Smith said that despite the general impression that opportunities for young engineers are limited in railroad service, a survey of the records of the present presidents of our railroad systems will show that one-third of the mileage of American railroads is headed by men who are engineering graduates. Another third is headed by graduates from other courses, and the remaining third are graduates of the school of hard knocks. He urged the railroad engineers to seek out opportunities to stimulate interest among college students in railroad engineering as a career.

Postwar developments

Mr. Smith took a sober view of the future of railroad transportation in this country. He said that the railroads now are handling much freight that has been "borrowed" from tankers, airways, waterways, buses and trucks. As an example, he cited the movement of oil in tank cars that normally moves by sea in tankers. He believes that a great reduction in income is inevitable in the postwar period as the railroads will get only such traffic as they can carry at less cost than on the waterways, highways and airways. He said also that the "inequality of opportunity" will be accentuated after the war when most public money will be spent on waterways, airways and highways. Mr. Smith raised question as to whether it may not become necessary for the railroads to seek federal subsidies in order to meet this competition.

To strengthen their competitive position, Mr. Smith said, the railroads in the postwar era must have a great output per man-hour, which means that they must make more use of mechanical devices and power tools. They must have better terminal facilities for handling freight and must

eir maintenance costs. He also said t much more research would be eded, and he criticized the AREA the complacency of its committees th respect to research.

The cost of high speed

The Committee on Economics of ilway Location and Operation, in report, said that the railroads in ir postwar planning, should not erlook the fact that the faster speeds ich the traveling and shipping pub- have come to expect and demand y produce a more rapid increase in enue than in expenses and, con- sely, that slower and more econom- l speeds may result in loss of traffic competing agencies. This may n a revision of traditional methods freight handling.

New culvert specifications

Specifications for structural-plate e and arches, prepared by the Com- ee on Roadway and Ballast, were roved for publication in the Man- of the association. The same com- tee submitted for publication in Manual specifications for pre- ed stone, slag and gravel ballast. se also were approved. The com- tee noted that most railroad bal- specifications now are not in con- nity with recently developed wledge with respect to ballast ma- als.

The committee reported that it had found it practical to write a gen- specification for chats ballast as size of that material depends al- t entirely upon the source.

. T. Goldbeck, engineering direc- National Crushed Stone Associa- , reported that research is about tart on an adaptation of the Los eles abrasion test to the larger of stone, up to 2½ in. The test is applicable only to the smaller .

Better quality rail

ail-failure statistics compiled by Committee on Rail indicate clearly efforts to improve the quality of are producing results. The 5-year rd for rail rolled in 1937 showed verage of 23.9 failures per 100 of track, which is the lowest so far recorded. The 5-year fail- ate of 1937 rail is lower than the year failure rate of 1912 rail.

he apparent conflict between this ment and the committee's report of an increase in rail failures due to transverse fissures in the year 1942 was explained by the committee as due to the fact that a great majority of the failures of this type occurred in the older rail. Also, as these failures are a function of the weight and speed of traffic, the rate was bound to rise under the exceptionally heavy traffic load now carried by the railroads.

A marked reduction in transverse fissure failures has resulted from heat treatment of rails. No fissures have been reported in any rails rolled since the Brunorized process of heat treatment was revised in April, 1938.

Welded construction

Revised specifications for welded structural steel for railway building were approved at the meeting for inclusion in the Manual. These are a revision of similar specifications approved by letter ballot last year.

Fire-resistant wood

The Committee on Buildings also submitted an important report on fire-resistant wood for railway buildings, which includes a bibliography of current specifications relating to fire tests of wood and wood construction, with comment on the specifications. Also included was a set of tentative specifications for fire-resistant treatment of timber and lumber.

Bridge design data

A revision of formulas for distribution of live loads on bridges, submitted by the Committee on Iron and Steel Structures, was approved for substitution for the formulas now in the Manual, as was a revision of the section on impact in the Manual.

The special Committee on Impact reported that the electro-magnetic strain gages acquired by the committee some time ago have proved to be very valuable in the test which it is conducting, especially those made for some of the railroads to determine the maximum stresses that are developed under heavy motive power.

A summary of this committee's report on one of its studies was published in *ENR*, Dec. 16, 1943, p. 899.

New design drawings for timber trestles and timber-bridge decks, submitted by the Committee on Wood Bridges and Trestles, were approved for substitution for the drawings now in the Manual. Trestle and timber deck designs now in the Manual, according to the committee, were for structures built of untreated timber. The new designs give recognition to the changes that should be made when treated timber is used.

Included with the new material for the Manual are tables showing the stresses that will be developed in timber trestles under standard loadings.

Concrete structures

Approval was given to new specifications for concrete and reinforced concrete railroad bridges and other structures submitted by the Committee on Masonry for substitution for similar specifications now in the Manual. These specifications cover materials, aggregates, mixing water, metal reinforcements, proportioning, storage of materials, joints, mixing, depositing concrete in air, under water, in sea water and in alkali soils or water, curing, and surface finishes. Also included are specifications for machine mixing at a central plant or on the job and for truck mixing.

The special Committee on Waterproofing of Railway Structures reported on extensive comparative tests that it has made of waterproofing asphalts and coal-tar pitches. From these tests the committee concluded that: "Asphalts have better ductility at low temperatures, which in certain installations would be of value in resisting cracking. Some advantage for asphalt is also indicated with respect to water or acid entering through holes resulting from bubbles in the coating. The tests to determine the relative resistance of asphalt and pitch to water penetration do not seem conclusive or entirely satisfactory. The pitches show less water absorption and this indicates greater resistance to water penetration."

New Specifications Approved by the A.R.E.A.

Structural-Plate Pipe and Arch Culverts • Prepared Stone, Slag and Gravel Ballast • Welded Structural Steel for Railway Buildings • Fire-Resistive Treatment of Timber and Lumber • Concrete and Reinforced Concrete for Bridges and Railroad Structures

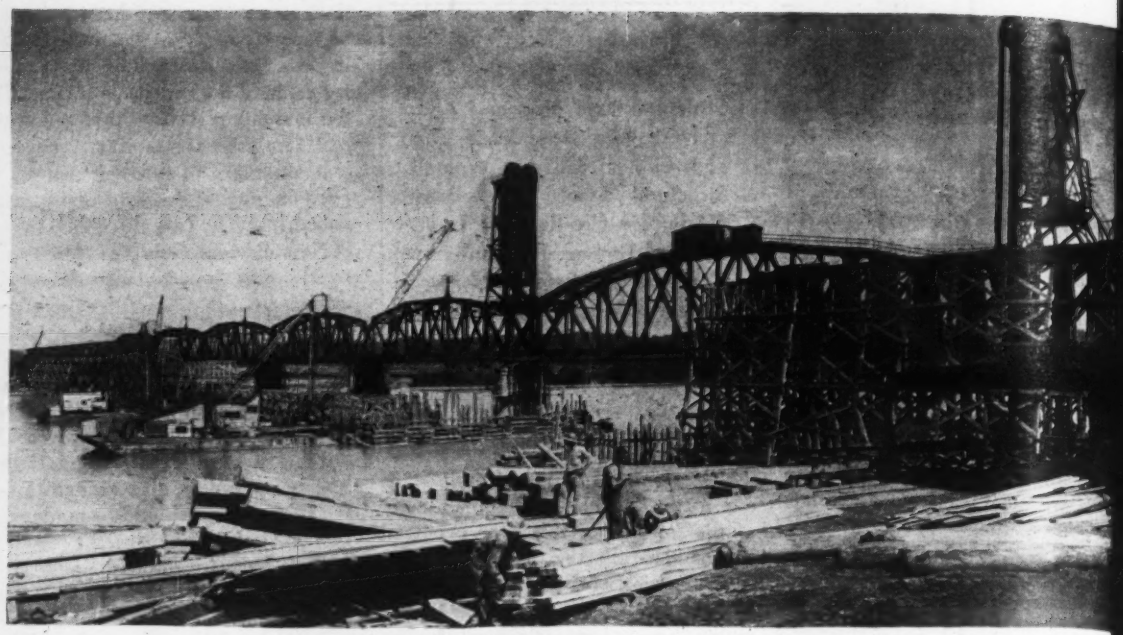


Fig. 1. First operation in raising this railroad bridge across the Tennessee River was to build a timber bypass trestle

Railroad Lift Bridge Raised Eighteen Feet

***Contents in Brief**—A steel-truss, vertical-lift railroad bridge across the Tennessee River is being raised 18 ft. to be above pool level of the Kentucky Dam reservoir. The truss spans are lifted in about 3-ft. increments by two hydraulic jacks under each end floorbeam. As jacking progresses, the reinforced concrete piers are increased in height. To provide a bypass while the bridge is raised, a 1,700-ft. temporary timber trestle of 75-ft. maximum height was constructed by two floating rigs handling 20-ft. high bent sections assembled on land.*

MUCH DIFFICULT CONSTRUCTION is now in progress in raising several bridges in the Kentucky Dam reservoir area above maximum pool level. Most outstanding of the railroad projects is that of raising 18 ft. the Tennessee River crossing on the main line of the Louisville & Nashville R. R. between Memphis, Tenn., and Louisville, Ky. Heavy loads, including those for a vertical-lift span and the adjacent tower spans, must be accommodated. Also the existing piers, which are of considerable height, required modification.

Raising operations required that the crossing be removed from service. Since traffic could not be re-routed or discontinued, a timber trestle believed to be one of the largest bridges of its type ever built in the eastern part of the United States was constructed about 100 ft. downstream from the permanent crossing to provide a bypass (Fig. 1). Construction of this structure will be described in detail later.

Located near the town of Danville, 78 miles from the mouth of the river and 56 miles upstream from the dam, the existing bridge was built in 1931. It consists of five 200-ft. through-truss spans, one 178-ft. span of similar design, a 299-ft. lift span, and one 74-ft. through girder span. The trusses, which are spaced 18 ft. c. to c., are supported on reinforced-concrete piers varying in height from 50 to 90 ft. and resting on rock or consolida gravel of high-bearing capacity.

Before the actual operation of ra ing the bridge was started the t several feet of the existing piers, whi had battered faces, were encased wi 18 in. of concrete of 2,500-psi. mi mum compressive strength at 28 da This encasement extends from a fe feet below low pool to the top of t piers (Fig. 2). It was added for tw purposes: (1) To eliminate the pla of weakness at the junction betwe the old bridge seats and pier exte sions and (2) to make the extend pier equal in size at the top to that the existing pier, as required to a commodate the old bearings.

The encasement was keyed to t old construction as shown in Fig. Steel cross ties also were extend through the pier to further tie the e casement to the existing concrete. R inforcing in the encasement consists ¾-in. horizontal bars on a 12-in. sp ing and 1-in. vertical bars on abo 10-in. centers. This steel was plac with a minimum clearance of 3 i from the exterior face of the concre

other operation carried out be- acking was begun was that of g the lift span from the 750,000- unterweights at each end, in that the lift span could be raised endently of the tower spans. This was accomplished by discon- g the lifting cables after the erweights had been supported eams stored in the tower fram- d used for this purpose when re- are required. Also, a guy was ed on both sides of each tower vide some measure of protection t a sudden increase in wind y during jacking. Each guy s of two $\frac{5}{8}$-in. dia. wire cables. joined to the tower framing 30 ft. above base of the rail and s to the nose of the pier on that Equipped with 3-ft. turnbuckles, bles are slackened off as jacking sses.

trusses are raised in about 3- rements by two hydraulic jacks each end floorbeam (Fig. 3). acks rest on the pier and are 9 ft. apart, which makes them 6 in. from the centerline of the Dead load per shoe totals 106 with the simple 200-ft. trusses; ons below the towers, and 236 nder the lift span. To accommo- these loads 250-ton jacks are yed. An exception is the 500- cks used at the towers.

general jacking procedure is k from the east to the west end, each span about 3 ft. and then ing to the east end to repeat the ion. An exception to this method the lift span is raised before the spans, which is necessary be- the tower spans would not clear ft span if raised first. With the g crews advancing from span to all the required operations can ried out simultaneously to speed etion of the work.

h ends raised simultaneously

o 7-man jacking crews raise ends of a span simultaneously. acks at the four corners of the are operated independently, but s exercised by the jacking crews end all four jacks at about the rate. As jacking progresses $\frac{1}{8}$-in. oak shims are placed beneath shoe. When the thickness of the which are added as a safety tion only, reaches about $9\frac{1}{2}$ in., re removed and three rows of precast concrete blocks are inserted under each shoe. The blocks are spaced about 2 in. apart, and on top of each is added a $\frac{1}{8}$-in. thick lead plate equal in length and width to the concrete blocks.

Ordinarily, each time a layer of blocks is installed beneath the shoes similar blocking is added under the jacks. With this blocking in place, jacking continues until another layer of blocks can be placed beneath the shoes, this layer being laid at 90 deg. to those immediately below.

When a truss has been raised about 3 ft., the height of the pier is increased an equal amount with cast-in-place concrete. For the intermediate lifts the blocks under the shoes are encased in the concrete. This concrete is poured with the spans supported on crib blocks under the shoes, the jacks and cribbing under the jacks being removed. For the last lift only, a timber bulkhead is built around the blocks under the jacks, which permits these blocks to be removed later and this space filled with concrete while the trusses are supported on the shoes.

A concrete designed for a strength of 2,500 psi. at 7 days is used to extend the piers. A 1-cu. yd. batch is proportioned as follows: Cement, 94 lb.; gravel, 298 lb.; sand, 191 lb., and water, 6 gal. To permit a more rapid scheduling of operations, high-early strength cement is used, which allows jacking operations to continue at a pier two to three days after the last pour at that point.

Concrete manufactured on shore

Concrete for extending the first three piers at the west end of the bridge is prepared in $\frac{1}{2}$-yd. mixers set up at ground level at that end of the bridge. It is pumped to the point desired through a 6-in. pipe. Concrete for the other piers is manufactured by $2\frac{1}{2}$-yd. portable mixers operating on shore at the east end of the crossing.

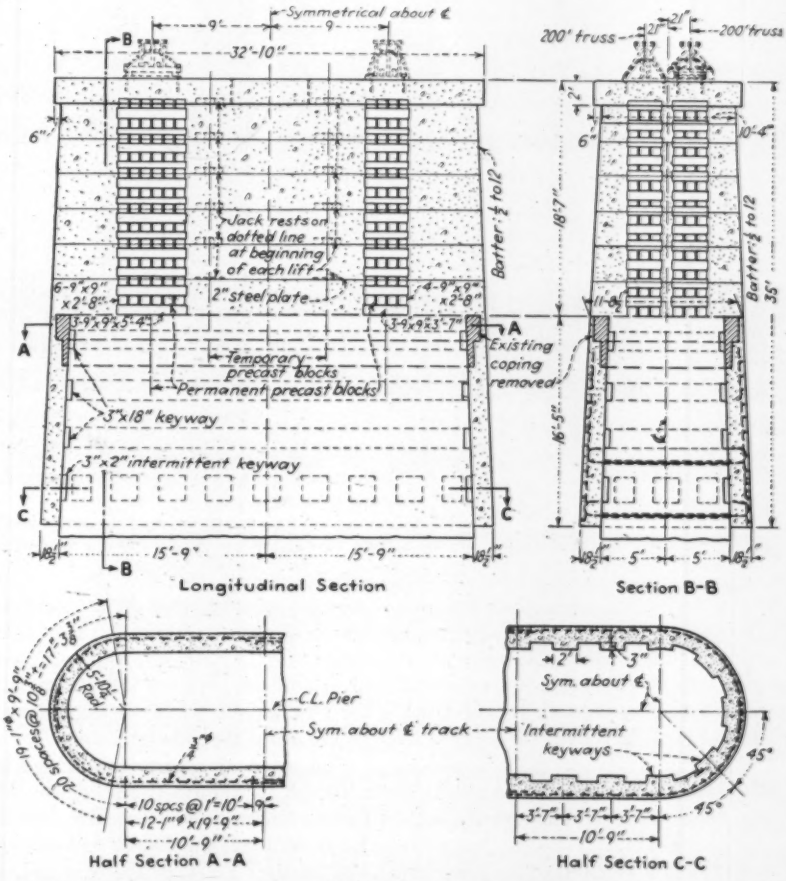


Fig. 2. Before the work of raising bridge was begun, the existing piers were encased at the top with 18 in. of concrete. During the jacking work, height of piers is increased in about 3-ft. increments. For clarity, reinforcing is not shown in detail at upper left nor in top portion of detail at upper right.

Fig. 3. Trusses are being raised by two hydraulic jacks under each end floorbeam. A typical jack supported on the on precast concrete blocks is shown at left. The hand-operated pumps employed to extend the jacks are illustrated at

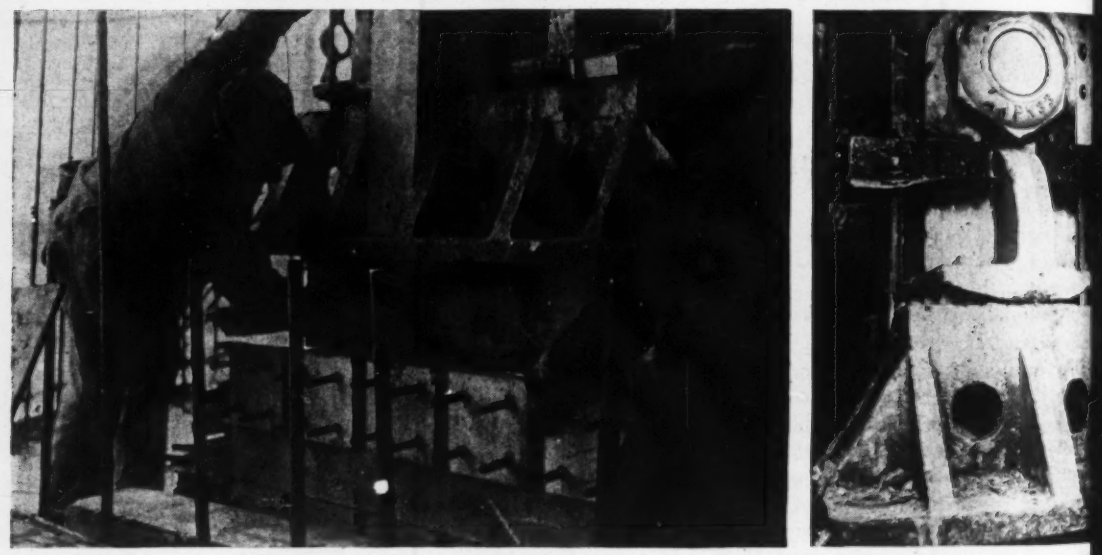


Fig. 4. As trusses are raised precast concrete blocks separated by thin lead sheets are added below the shoes of the t During jacking, lower portion of each shoe is supported by four bolts extending upward to angles welded to top o

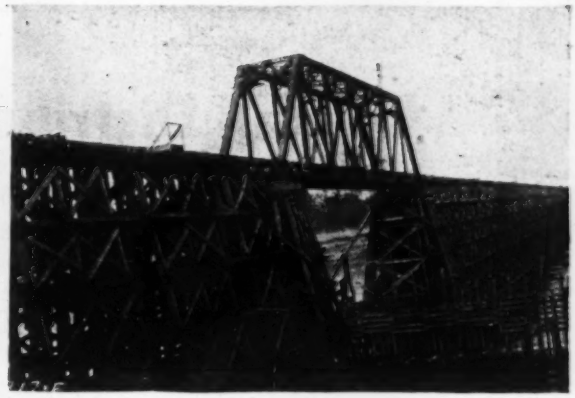
A materials elevator delivers the concrete from this mixer to a hopper supported at the center of the bridge at sufficient elevation that an end-dump truck may pass beneath it. The truck shuttles back and forth on the deck of the bridge to deliver the concrete to the desired pier, the railroad rails having been replaced temporarily with timber planking.

Forms for extending the piers are made of 1-in. sheathing nailed over 2x6-in. studs. The nose forms, which are 6 ft. high, are used for two 3-ft. pours and then replaced, new forms being required to provide the desired batter of one to twelve. The side forms, also 6 ft. high, are being used to extend the pier the full 18 ft. All the form panels are handled by blocks swung from the superstructure.

The work of raising the bridge is expected to require traffic to use the bypass crossing several weeks. Nearly 1,700 ft. long, the trestle consists of 108 bays of 12 ft. at the east end, a 157-ft. through truss span at the main channel, and eighteen 12-ft. bays at the west end. Oak, pine, fir and gum timber, whatever could be obtained as needed, was used for the piling, ing and posts; caps and track ers are pine. Much of the tresl ft. high. The bents, with the members 12x12-in. posts, ar ported on from six to eight 12- treated piles 30 to 60 ft. long. of the bracing and the deck co tion are shown in Fig. 6.

Construction proves difficu

Because of high water encou and the size of the structure, co tion of the trestle proved difficul piles were driven with a double-



The 157-ft. steel truss span of the temporary bypass was erected on temporary cribbing supported by two 60-in. double girders. Floor system of truss span is shown in place in the left picture. Temporary timber bypass complete, including the 200-ft. long fenders protecting the piers of the truss span, is illustrated at the right.

er with a 5,000-lb. driver han-
y a floating steam rig with a
boom. Driving continued until
imum bearing capacity of 22
er pile was obtained.

bents were fabricated with
and drift pins in 20-ft. heights
east bank. They were erected
by story by two floating rigs
about 110-ft. long booms (Fig.
bent sections were delivered to
gs by barge, a stiffleg derrick
at the water's edge transferring
nt sections from the fabricating
the barges. Generally, one rig
d one story and the second fol-
behind to erect the next. Each
s able to erect four to six bents
hr. shift, the longitudinal brac-
d scaffolding being added after
ent was raised.

ction of the through-truss span
he most difficult operation in
ng the trestle. Once the re-
l piers, which are each made up
10-pile bents braced much as
previously described, were in
two double 60-in. plate girders
erected one at a time and sup-
d temporarily on the piers, as
by Fig. 6. After the girders had
seated, the members for the two
s were floated to the desired lo-
on barges and the trusses
d on this falsework. When erec-
f the truss span was completed,
lsework girders were removed.
trestle required two and one-
million board feet of lumber.
tions continued over a period of
nths, but several weeks were lost
e of floods and delay in the de-
of materials. Work continued
daylight to dark, and the labor
averaged about 110 men.

The trestle was built by the Tennessee Valley Authority, with its own forces, which is financing all the work described. For the TVA, C. E. Blee is chief engineer, George R. Rich, chief design engineer, K. C. Roberts, head structural design engineer, and W. J. Starr is in charge of field engineering on all major bridge construction in the Kentucky Reservoir area. A. L. Pauls is chief construction engineer, G. P. Jessup, project manager of the Kentucky project, W. O. Billiter, construction superintendent on the job, with W. H. Farrar, R. V. Weldon and J. M. Hoyt in direct charge at the site.

On reconstruction of the permanent crossing, TVA forces encased the piers. The Fehlhaber Pile Co., New York, with Joseph DeVido general superintendent, is the general contractor for the remainder of the construction, which is to be completed early in the year. The jacking work is being done as a sub-contract by the Fichter Steel Co., New York, with Charles Haass general foreman.

J. W. Hoyt as resident engineer represents the Louisville & Nashville R. R.

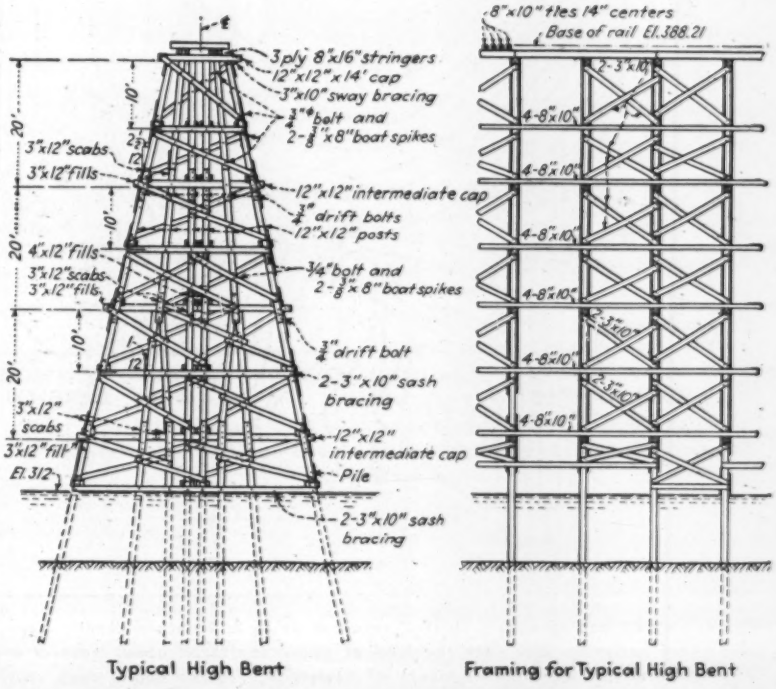


Fig. 6. Major portion of timber trestle is 75 ft. high with the bents, which are on 12-ft. centers, made up of 12 x 12-in. posts braced with 3 x 10-in. sash bracing.

Rainfall Distribution at Louisville

C. Frank Johnson,
Chief Engineer, Commissioners of Sewerage of Louisville, Ky.

***Contents in Brief**—Records obtained with a group of recording gages revealed that the annual precipitation in a given year may vary from 84.4 to 121.9 per cent of the "Official" figures over a limited area. The studies also showed that storms of short duration and of the maximum intensity ever recorded at one gage may result in no precipitation at other gages nearby.*

RAINFALL DATA obtained at Louisville, Ky., during a 15-yr. period are of interest because of the striking manner in which they illustrate the wide variation that may occur in annual precipitation over a comparatively small area. The records also show that rainfall intensities during a given storm may vary widely at gages relatively near together.

The data were obtained from 1927 to 1941 by the U. S. Weather Bureau at its automatic recording gage in Louisville and by the Commissioners of Sewerage of Louisville at several gages distributed over the city and its environs. Some of the latter gages were of the "standard" U. S. Weather Bureau stick-measuring type and the remainder automatic recording units.

The U. S. Weather Bureau gage, which is designated Gage No. 11 on the accompanying charts, was located 183 ft. above street level on the top of a building near the Ohio River in the north-central section of the city. The commission's thirteen gages were placed a few feet above the ground, most being on low buildings and the remainder on prepared bases of convenient height for the observer. They were located at the points indicated in Fig. 1.

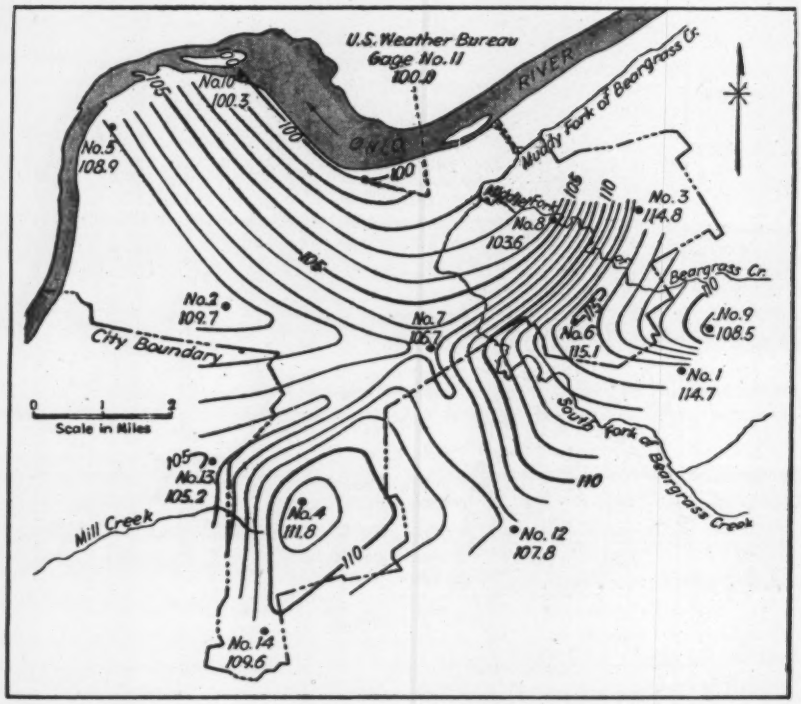


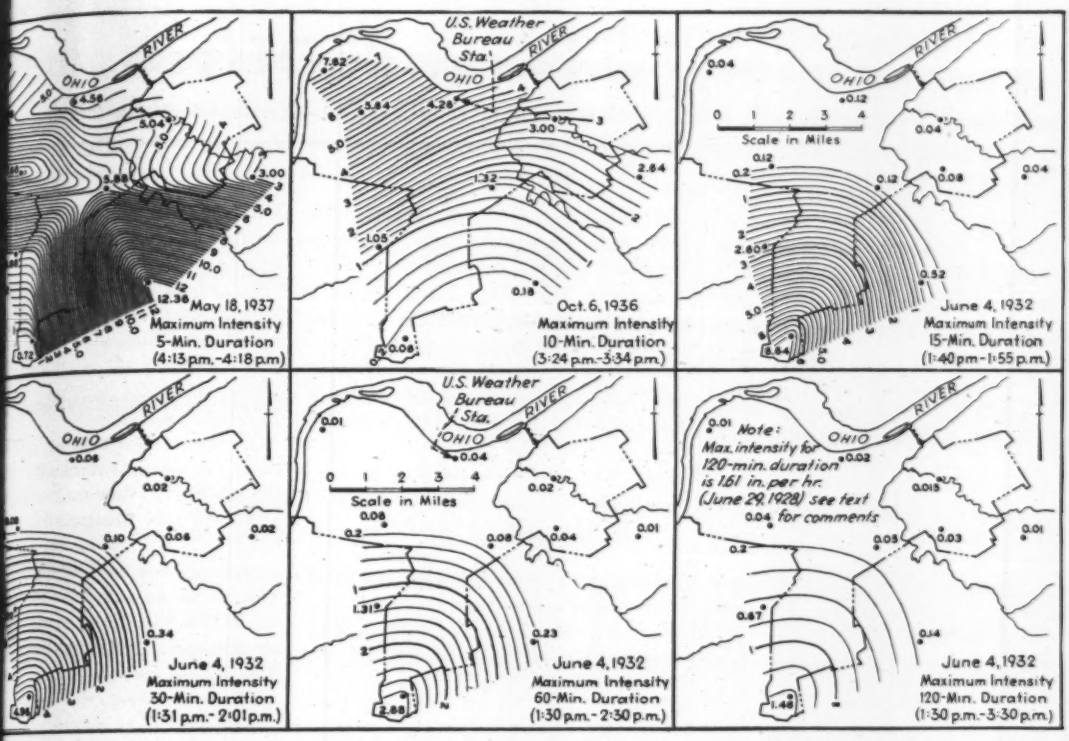
Fig. 1. Comparison of annual rainfall received at U. S. Weather Bureau gage in downtown Louisville with that received at gages scattered about general area and operated by the Commissioners of Sewerage. Figures below each station number indicate total precipitation at that point compared to Weather Bureau station total, which represents one hundred percent. The lines connect points of equal percentage.

A comparison of the records of the Weather Bureau gage with those of the commission's gages, shows that widely varying amounts of rainfall have been recorded at the different sites during each of the years. The amounts of rainfall received during any one year at the various locations has ranged from 84.4 to 121.9 per cent of the total observed at the Weather Bureau gage during the same year. However, the long-time average amount at the commission's gages has generally been in excess of the amount measured at the government gage. This fact is shown by the accompanying table, which gives results for locations where the gages were removed for a 9-yr. period or longer.

Two areas of high rainfall

The data of the table are shown graphically in Fig. 1. This illustration clearly indicates two regions of high rainfall, both in the eastern and southern sections of Louisville. These high areas are in the hilly portion of the city, while the areas of lower rainfall in the northern and western sections are in the flat flood plain of the Ohio River. Prevailing winds in the Louisville region are from the southwest.

The intensities of rainfall vary considerably at the individual gages during any storm. As a rule, high intensities for periods of, say, one or two hours, such as are applicable in designing combined sewers or storm sewers, covered limited areas. The distribution of intensities observed at Louisville for rainstorms having the maximum rates for periods of from 5 to 120 min. is shown in Fig. 2.



...obyetal lines through points of equal intensities for storms from 5- to 120-min. duration. The solid circles show ...tion of the gages, and the numbers adjacent represent the intensity in inches per hour.

...ntensities illustrated by this ... are the maximum values ob... ...r the respective durations, at ...e in Louisville, from 1896 to ...n exception is the 120-min. ..., when the next-to-maximum ... is shown. At the time of the ...m intensity for 120 min., there ...t enough gages in operation ...distribution to be determined ...ly.

...the maximum intensity re... ...t one gage never extended as ...n adjacent gage is indicated ...2. In fact, for some durations the intensity at several gages was only nominal at the time the maximum intensity was observed at one of the gages. Also, it will be noticed that none of the maximum intensities occurred at the gage of the U. S. Weather Bureau. Another interesting feature of the records is that all the storms of maximum intensity occurred in the afternoon.

Records of the distribution of rainfall have been used to advantage by the Commissioners of Sewerage of Louisville in designing combined sewers and storm sewers serving areas of 500 acres or greater. A "distribution factor" has been applied, reducing the intensity of the rainfall used in these cases. The value of this factor depends upon the extent of the tributary area and the duration of the rainstorm.

...RISON OF RECORDINGS AT WEATHER BUREAU GAGE AND THOSE OF COMMISSIONERS OF SEWERAGE,

...ion gage number	Period	Annual rainfall, in inches, for period shown: At commission gage	Annual rainfall, in inches, for period shown: At Weather Bureau gage	Percent at commission gages compared with amount at W. B. gage
.....	1929–1937	42.99	37.49	114.7
.....	1927–1941	42.79	39.02	109.7
.....	1930–1941	42.81	37.30	114.8
.....	1930–1938	41.65	37.27	111.8
.....	1927–1941	42.48	39.02	108.9
.....	1928–1938	43.68	37.96	115.1
.....	1929–1941	30.12	37.59	106.7
.....	1933–1941	40.04	38.66	103.6
.....	1933–1941	41.96	38.66	108.5
.....	1929–1941	37.71	37.59	100.3
.....	1931–1941	41.51	38.52	107.8
.....	1931–1941	40.51	38.52	105.2
.....	1931–1941	42.20	38.52	109.6

Chilean Rail Lines Are Improved

Despite wartime obstacles, Chile has made considerable improvement on her railways, including construction work on the Antofagasta-Salta Railway across the Andes and installation of seven electric locomotives and other equipment obtained from the United States. A $5,000,000 credit from the Export-Import Bank of Washington is helping the Chilean State Railways finance the improvements.

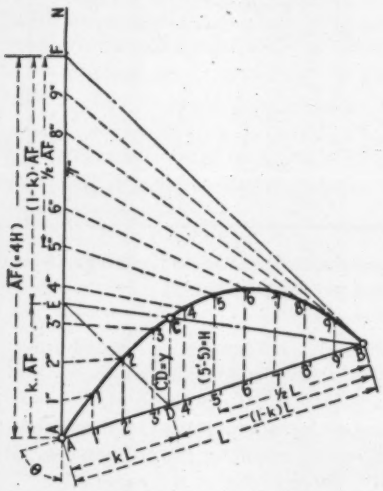
Looking to the future, Chile has authorized its State Railways to request bids from United States equipment suppliers for the electrification of lines between Santiago and Talca, and Santiago and Cartagena, Paine and Talagante—a total of approximately 248 miles.

From Field and Office

WORKING PROBLEMS AND TIME-SAVING METHODS FOR ENGINEERS AND CONTRACT

Graphical Construction of Parabola Through Three Points

Construction of a parabolic curve, which is a somewhat tedious procedure by plotting a series of ordinates determined by mathematical solution of the parabolic equation, may be done graphically with an appreciable time saving. The accuracy of the resulting curve will depend only on the care exercised by the draftsman.



Typical example of a parabola constructed through three points by graphical method.

The only data needed is the length and slope of the base line, the direction of the ordinates with respect to this base line, and the numerical value of *any* single ordinate to the curve, hence the location of *any* single point on the curve. Since the ends of the known base line represent two other points on the curve, the problem is merely to graphically construct a parabola passing through three fixed points such that the ordinates to the curve will be parallel to a limiting direction.

The method can best be illustrated by example. Referring to the accompanying sketch, let *A*, *B* and *C* be the three fixed points and Line *AN* fix the direction of the ordinates to the proposed parabolic curve such that all ordinates are parallel to this line. The solution is as follows:

1. Connect Points *A* and *B*, the most widely separated points to form the Base Line of the parabola.

2. Draw Line *CD* through Point *C*, parallel to controlling Line *AN*, to intersect *AB* at Point *D*.

3. Draw a line through *B* and *C* and extend it to intersect *AN* at Point *E*.

4. Connect *D* to *E* and draw through *B* Line *BF*, parallel to *DE*, to intersect *AN* at Point F.

5. Divide Lines *AB* and *AF* into the *same number* of equal parts, say at least ten. (The accuracy of the final curve increases directly with the number of divisions used.) From *A* to *B* lable the division points 1′, 2′, 3′ etc. and from *A* to *F* use 1″, 2″, 3″, etc.

6. Through Points 1′, 2′, 3′, etc., draw guide lines parallel to *AN* and draw guide lines from *B* to Points 1″, 2″, 3″, etc., locating Points 1, 2, 3, etc., at the intersections of the similarly numbered lines such as 1′-1 and 1″-1, etc.

7. With the aid of a french curve draw the locus of Points A, 1, 2, 3, C —9, B. The resulting curve is the desired parabola.

Proof of the method is simple. By similar Triangles *ABE* and *DBC:*

$$\frac{DC}{AE} = \frac{Y}{AE} = \frac{DB}{AB} = \frac{(1-k)\,L}{L} = 1-k;$$

$$\text{Hence } Y = AE\,(1-k) \qquad (1)$$

By similar Triangles *ADE* and *ABF:*

$$\frac{AE}{AF} = \frac{AD}{AB} = \frac{kL}{L} = k.$$

$$\text{Hence } AE = AF\,(k) \qquad (2)$$

By similar Triangles *AB*5″ and 5′*B*5:

$$\frac{A5''}{5'5} = \frac{\frac{1}{2}AF}{H} = \frac{AB}{5'B} = \frac{L}{\frac{1}{2}L} = 2;$$

$$\text{Hence } AF = 4H \qquad (3)$$

By combining Equations 1, 2 and 3 there results:

$$Y = 4Hk\,(1-k) \qquad (4)$$

Equation 4 is the equation of the curve drawn through the Points *A*, 1, 2, 3, *C*,—*B* with respect to the Base Line *AB*.

Therefore, this curve is a parabola, since Equation 4 will be recognized as identical to the parabolic equation:

$$Y = Cx\,(L-x) = \frac{4H}{L^2}(x)\,(1-x) = 4Hk\,(1-k)$$

Where *L* is the base line length, the maximum ordinate at $x = \frac{1}{2}L$ $x = kL$.—DONALD A. DUPLA *Chief of Structures, Nashville Consolidated Vultee Aircraft Nashville, Tenn.*

Dowels Installed Without C

Workers constructing plain crete runway extensions at Rogers Field, Oklahoma City, us job-made tool illustrated to eli the needs for chains to supp dowel bars for the longitudinal The workman using the tool, w made of a ¾-in. reinforcing steel on the back of the finishing m The tool is pushed into the co until in contact with the su which places the dowel at the d depth from the bottom of the sl

Workmen of Moran & Bu Muskogee, Okla., developed th It not only eliminates the nee chairs made of critical materi simplifies the installation ope

Installation of dowel bars in plai crete pavements may be made w chairs by above method.

Book Notes and Reviews

The month's addition to the engineer's reading and reference list

ilitary Report Writing

CORRESPONDENCE AND REPORTS—
C. Howell. 190 pp. McGraw-Hill
Co., New York 18, and London.

Howell's book on military
ondence should prove to be a
ent handbook for regimental
mpany officers who are ex-
o know the proper form that
ters and reports should take.
hor has undertaken to bring
he covers of a small book a
f all important army regula-
lating to forms and corres-
e.
t half the book is made up of
xes, including a handbook
on common errors in English
st of abbreviations peculiar to
operations.

Fluid Mechanics

ECHANICS—By R. C. Binder. 307
entice-Hall, New York. $5.
e words of the author, the aim
book is to present an intro-
to the fundamentals of fluid
ics; also, it is intended to
a guide to college professors
ging courses on the subject.
itle of the book is somewhat
ing; it is not a complete trea-
fluid mechanics as it does not
number of important branches
ience which are of the great-
est to the engineer and only
others of equal interest. For
, discussion of surface tension
illarity in liquids, of flow in
and in draft tubes, of oscillat-
ion and waterhammer, and of
soils, is entirely omitted.
ections on the stability of float-
ects and on turbines are so
that they have little, if any,
l value. In Chapter 8, describ-
various instruments and meth-
l for measuring discharge, no
is made of the Gibson salt-
method, which is generally
ed as one of the most accurate
sed and which is based on the
theory of interrupted flow in

On the other hand, the recent advances in the science of fluid mechanics related to steady flow of liquids and gases, developed by such eminent investigators as Prandtl, Karman, Dryden, Bakhmeteff and others, are ably and attractively presented. Chapters 10, 11 and 12, having application chiefly in airplane design and ballistics, are most interesting. Chapter 15, Lubrication, deserves special mention, as it gives an exceptionally clear demonstration of the basic theory and practical application of this all important device upon which the operation of moving machinery parts depends.

Credit is due to the author for stressing the advisability of using dimensional analysis and the principles of dynamic similarity in the interpretation of experimental data. Chapter 6 gives the explanation of these "tools" and the method of their application in practical cases.

Undoubtedly, the book will prove useful in the classroom for the study and national analysis of the phenomena associated with the types of steady flow of liquids and gases covered in the text.—*Reviewed by* EUGENE E. HALMOS, *Consulting Engineer, New York.*

An Engineer's War

PIPELINE TO BATTLE—By Major Peter W. Ranier. Random House, New York. $2.50.

Here is the best book of the war to date, and one to delight an engineer's heart. Not only does the author describe battlefront construction operations with uncommon facility, he lets you "see" topography, understand troop and armor deployment and sense strategy and follow tactics as though you were on the scene.

It is the story of Britain's great Eighth Army from the dark days of 1940, when it undertook the seemingly hopeless task of saving the Suez Canal, to the victorious entry into Tunis by the side of French and American troops in the summer of 1943. It is the chronicle of three years of dirt, disease and death spread over 2,000 miles of North African desert where 12 big battles and countless skirmishes exacted a quarter of a million casualties. And it is all interwoven with the experiences of a 50-year old Royal Engineer officer whose main job during those three years was to assure every fighting man a minimum of half a gallon of water a day. Between battles, he built camps and roads and kept a frontline railway in operation, but principally he was "just a water bloke" to use his own words.

Major Rainier's desert pipeline brought Alexandria's filtered water to the men at El Alamein, and his drilled wells kept up with General Montgomery on his three month, 1,400-mile chase of Rommel to Tripoli and beyond.

There have been other fine books about the war. Robert St. John's "Land of Silent People" and Russel Hill's "Desert Warfare" are of the best, but these men were correspondents, perforce only hitch-hikers on the chariot of war. Major Rainier was of the war. He lived it, and by many miracles lived to write about it, which he does superbly. Moreover, he draws freehand sketch maps of battle situations, which will earn him applause from every reader.

It is not possible to "brief" this book, which is compounded of such a wealth of information and entertainment on military movements, Middle East history and the plain dirty work of war, but it is possible to suggest its essential character by a few excerpts. There is for example the description of the use of old Roman *birs* or reservoirs for underground water storage right at the front lines; their plastered surfaces were found to be water-tight after 1,500 years. There is the account of the construction of 0.6 m.g.d. slow-sand filter plants within the fortified zones at El Alamein. And there is the tale concerning the Germans who surrendered after drinking from the pipeline when it was being tested with salt water, which had increased their thirst to the point of delirium.

The author helped Montgomery deceive the Germans by building dummy tanks and airplanes and parking them around the desert, and he constructed roads of saltmarsh mud, which the Germans thought were dummies, but which were used to get vehicles up to the front line on the day of the battle. The practice of ingenuity also had its amusing aspects, as when the author,

tired of constructing different type toilets for the Christians and the Moslems, developed a combination "sit and squat" design; or when he was confronted with the problem of convincing the troops that the water in the wells near the Mareth Line in Tunisia would not render them impotent. The solution of the latter problem was to connive with the Medical Corps officers to issue a statement to the effect that the lime that was put in the water was a special powder that destroyed the "dangerous bacteria."

Perhaps the outstanding engineering achievement of Major Rainier's little band of "sappers" was chalked up after the Germans were defeated at El Alamein. Then, in 20 days, they repaired 200 miles of the pipeline which the Germans had sought to destroy. They welded 459 breaks and installed 21 pumping sets, and as a sideline lifted nearly 400 mines that had been concealed under and along the pipeline. It is a thrilling and satisfying book, and one can only hope that it will provide a challenge to some American engineer officer to do as good a job in describing some of our own battlefront construction achievements.

Miscellaneous Notes on Booklets and Reprints

THE FEBRUARY ISSUE of "Pennsylvania Planning" is given over to a discussion of the value of air photographs in solving civil problems. Copies may be obtained from the State Planning Board, Pennsylvania Department of Commerce, Harrisburg, Pa.

GENERAL WELDING SEQUENCE is the title of a 75 pp. manual, extensively illustrated with sketches, recently published by the Western Pipe & Steel Co. of California (Shipbuilding Division), San Pedro, Calif. The author, Walter J. Thomas, welding engineer for this company, has a long background of experience in the welding field. The book discusses the general problem of welding sequences in ship construction. The causes of weld failures are reviewed, general instructions for shrinking and straightening are given as are instructions for hookup of welding leads on water-borne vessels to prevent corrosion resulting from electrolytic action. Other subjects covered include gas cutting, general specifications and tables of approved electrodes.

RECENT PAMPHLETS ON POSTWAR PLANNING include: "Construction in the Postwar Economy," The Producers Council, 815 Fifteenth St., N.W., Washington, D. C.; "Blue Prints For Peace," The Associated General Contractors of America, Carolinas Branch, 405 Builders Bldg., Charlotte, N. C.; and "Postwar Planning," a paper presented at the 58th annual meeting of the Engineering Institute of Canada, 2050 Mansfield St., Montreal, Que., Canada.

New Engineering Books

THE LAND DIVIDED—A history of the Panama Canal and other Isthmian Canal projects. By Gerstle Mack. 685 pp. Alfred A. Knopf, New York. $6.

ELEMENTS OF AERIAL PHOTOGRAMMETRY—By Earl Church. 95 pp. Syracuse University Press, Syracuse, N. Y.

1943 SUPPLEMENT TO A.S.T.M. STANDARDS INCLUDING TENTATIVE STANDARDS—Part II, Nonmetallic Materials — Constructional. 167 pp. American Society for Testing Materials, Philadelphia.

TESTING OF ENGINEERING MATERIALS—By Carl W. Muhlenbruch. 200 pp. D. Van Nostrand Co., New York. $2.75.

THE HOUSING MARKET IN NEW YORK CITY—By Herbert S. Swan. 204 pp. Reinhold Publishing Corp., New York. $2.

TVA—DEMOCRACY ON THE MARCH—By David E. Lilienthal. 248 pp. Harper & Bros., New York and London. $2.50.

THE POWER INDUSTRY AND THE PUBLIC INTEREST—261 pp. The Twentieth Century Fund, 330 W. 42nd St., New York. $2.

MILITARY MAPS AND AIR PHOTOGRAPHS—By A. K. Lobeck and Wentworth J. Tellington. 256 pp. McGraw-Hill Book Co., New York and London. $3.50.

Reports and Pamphlets

REPORT OF THE SUFFOLK COUNTY MOSQUITO EXTERMINATION COMMISSION—Yaphank, L. I., N. Y.

ENGINEERS' COUNCIL FOR PROFESSIONAL DEVELOPMENT, Eleventh Annual Report for Year Ending Sept. 30, 1943. 33 West 39th St., New York 18, N. Y.

NORTH CAROLINA—23rd Annual Re... the State Board of Registration fo... neers and Land Surveyors to the G... for the Year 1943.

DEPARTMENT OF WATER RESOURCES... Biennial Report of the State Engi... the Governor of Colorado for the... 1941-1942.

YEAR BOOK, CITY OF CHARLESTON, ... 1942.

THE INSTITUTE OF SEWAGE PURIFI... Journal and Proceedings, 1942—... sex, England.

ANNUAL REPORT OF THE COMMISSIO... THE BUREAU OF RECLAMATION ... SECRETARY OF THE INTERIOR—Re... from the Annual Report of the Se... of the Interior for the Fiscal Year... June 30, 1943.

LAWS AND REGULATIONS Applicable ... eral Contracting in the State of ... Carolina. List of Licensed Genera... tractors. North Carolina Licensing ... for Contractors. Raleigh, N. C.

REPORT ON WAR AND POST-WAR A... MENT POLICIES, Feb. 15, 1944—B... nard M. Baruch and John M. Ha... Superintendent of Documents, Wa... ton, D. C.

STYLED HIGHWAYS FOR TOMORROW in ... Louis Metropolitan Region—St. ... Chamber of Commerce, Jan. 1944.

REPORT ON THE SEDIMENTATION SURV... LITTLE ROCK RESERVOIR, Los An... CALIF.—By Carl B. Brown. Speci... port No. 6, U. S. Soil Conservation ... ice, Washington 25, D.C.

THE MASTER PLAN FOR THE CITY ... RONTO AND ENVIRONS, Dec. 31, 1943... Planning Board of Toronto, Ont., C...

ABSTRACTS OF EARTHQUAKE REPOR... THE PACIFIC COAST AND THE W... MOUNTAIN REGION, January, Feb... March, 1943. U. S. Coast and Ge... Survey, Washington, D. C.

DENSITY OF SEDIMENTS DEPOSITED IN ... ERVOIRS—By E. W. Lane and Vir... Koelzer. University of Iowa, Iowa ... Iowa.

WASHINGTON, A PLANNED CITY IN E... TION—An address by Maj. Gen. U... S. Grant, 3rd, Chairman, National C... Park and Planning Commission. ... Committee on the National Capital, ... ington, D. C.

A COLLEGE COURSE IN CONSTRUCTION ... NEERING—By Adolph J. Ackerman... printed from the *Journal of Engine... Education*, January, 1944.

CONSERVATION OF FUEL FOR WA... Oliver Bowles. The Industrial Me... Wool Institute, 441 Lexington Ave., ... York 17.

...—Still going strong, ...-cycle Diesel veterans ... a mountain into the ... a Pacific base.

back in Action!

...g around for the engine to warm up. Lubricating truck wheels only once every ...00 hours saves on greasing time, too!

The records that 2-cycle Diesel tractors have made and are making on giant ...efense projects and on the war fronts are your assurance they will stand up to any ...eace-time job—no matter how tough. Figure on them for your Postwar construction.

ALLIS-CHALMERS

TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

CONTRACT UNIT PRICES

What contractors are bidding on different kinds of construction work

STREET IMPROVEMENTS, CINCINNATI

OWNER: Cincinnati Dept. of Public Works, H. H. Kranz, city engineer.

PROJECT: Improvement of Merlin Avenue in Cincinnati, from Plainville Road to 379.94 feet west of Marietta Street, by grading; installing 15-in. sewer of concrete pipe in Merwin Avenue from Blaney Avenue to 185 feet east; installing 18-in. sewer outlet of concrete pipe in Blaney Avenue from Merwin Avenue to Britton Avenue; installing 12-in. sewer outlets of concrete pipe in Marietta Street from Merwin Avenue to Windward Street and from the west terminus of Merlin Avenue to 140 feet west; installing other necessary drains and inlets; making necessary changes in and additions to water distribution system; installing sewer and water house services within street lines where necessary; laying cement walks; and constructing 24-ft. concrete roadway having concrete curbs integral with pavement.

CONDITIONS: Contractor to furnish all materials except cast iron pipe, fire hydrants, service pipe and fittings, and curb boxes. Alternates were allowed for pipe sewers, concrete or vitrified. Contract awarded on basis of concrete sewers. Rail and highway transportation facilities available. Cincinnati wage rates are: skilled labor, $1.45 to $1.75 per hour; and common, 85c.

BIDS: Six bids were received January 25, 1944, ranging from the contract low of $27,418 to $39,968. Engineer's estimate, $29,780.

LIST OF BIDDERS:

1. Murdock Constr. Co. and S. A. Ruebel & Co., Norwood, Ohio $27,418
2. A. F. Jelen & Sons, Cleves, Ohio 28,201
3. O'Connell & Sweeney, Inc., Cincinnati, Ohio 29,678
4. DeSalvo Constr. Co., Cincinnati, Ohio (vitr. pipe) 29,706
5. W. L. Harper Co., Cincinnati, Ohio 30,377
6. Crumley, Jones & Crumley Co., Cincinnati (conc. pipe) 39,645 (vitr. pipe.) 39,968

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Grading, excavation	4,200 c. y.	$0.38	$0.45	$0.50
2. Removing trees	5 s. f.	15.00	5.00	5.00
3. Hauling old materials	700 c. y.	.35	.60	.50
4. Sodding	2,809 s. y.	.23	.23	.25
5. Concrete pavement, 8-in.	4,850 s. y.	2.52	2.50	2.70
6. Macadam pavement base course	650 s. y.	.65	.55	.75
7. Concrete curbs	251 l. f.	1.25	1.00	1.00
8. Integral conc. curbs, rolling	3,200 l. f.	.30	.30	.30
9. Cement walks	7,000 s. f.	.22	.22	.25
10. Concrete driveways	4,300 s. f.	.28	.28	.30
11. Concrete masonry mix (1:6)	4 c. y.	18.00	15.00	18.00
12. Form and finishing steps	80 l. f.	1.50	1.00	1.00
13. Standard manholes	4 ea.	130.00	120.00	120.00
14. Manholes readjusted	9 ea.	20.00	10.00	10.00
15. Inlets, single grate	3 ea.	27.00	40.00	27.50
16. Inlets, double grate	10 ea.	45.00	50.00	40.00
17. Hauling sewer castings	10 ton	4.00	4.00	5.00
18. Brick masonry	33 c. y.	15.00	30.00	25.00
19. House drains	400 l. f.	.90	1.00	1.00
20. Lay 6-in. c. i. pipe, valves and special castings	202 l. f.	.80	1.00	1.00
21. Install 6-in. valves on exist. mains	2 ea.	20.00	15.00	10.00
22. Haul and set 6-in. fire hydrants	2 ea.	25.00	20.00	10.00
23. Plug exist. 6-in. tees and mains	1 ea.	5.00	6.00	10.00
24. Lower existing 6-in. water main	1,200 l. f.	.75	.65	.60
25. Lower exist 3-in. to 2-in. service branches	1,050 l. f.	.75	.65	.75
26. Haul and install ¾-in. serv. pipe and fittings	180 l. f.	.60	.40	.40
27. Haul and install curb boxes	7 ea.	1.00	2.00	1.00
28. Reset existing curb boxes	41 ea.	1.00	1.00	1.00
29. Brick masonry for valve chambers	10 c. y.	32.50	30.00	30.00
30. Concrete masonry for valve chambers	6 ton	12.00	15.00	15.00
31. Wiping joints	28 ea.	4.00	3.00	3.00
32. 12-in. conc. pipe sewers	425 l. f.	1.00	2.25	2.50
33. 15-in. conc. pipe sewers	220 l. f.	3.00	3.50	3.75
34. 18-in. conc. pipe sewers	270 l. f.	4.90	5.00	5.00
35. Concrete inlet connection, 12-in.	380 l. f.	1.85	2.00	2.00
36. T-branches on 12-in. conc. pipe	5 ea.	1.25	1.20	1.
37. T-branches on 15-in. conc. pipe	10 ea.	1.50	2.00	1.
38. T-branches on 18-in. conc. pipe	5 ea.	2.50	2.50	2.
39. Concrete bends, 6-in.	40 ea.	.90	1.00	1.
40. 12-in. vitr. pipe sewers (alt.)	425 l. f.		2.50	
41. 15-in. vitr. pipe sewers (alt.)	220 l. f.		3.90	
42. 18-in. vitr. pipe sewers (alt.)	270 l. f.		5.50	
43. Vitr. inlet connection, 12-in. (alt.)	380 l. f.		2.25	
44. T-branches on 12-in. vitr. pipe (alt.)	5 ea.		1.70	
45. T-branches on 15-in. vitr. pipe (alt.)	10 ea.		2.75	
46. T-branches on 18-in. vitr. pipe (alt.)	5 ea.		3.50	
47. Vitrified bends, 6-in. (alt.)	40 ea.		1.00	
48. Haul waterworks castings	6 ton	2.00	4.00	1.

WATER MAINS, DALLAS, TEX.

OWNER: City of Dallas, Tex.; John Winder, chief engr., Ci Waterworks Dept.

PROJECT: Construction of 30-in. and 16-in. cast iron wat mains for extension to Dallas, Tex. water supply system. I cludes furnishing and installing approximately 16,000 ft. 30-in. cast iron pipe; 10,000 ft. of 16-in. pipe; 1,500 ft. of 1 in. pipe; 1,500-ft. of 8-in. pipe; 55 tons of cast iron speci fittings; and necessary gate valves. Also involves concre structures and replacing of pavement.

CONDITIONS: Contractor to furnish all materials and com plete work in 90 calendar days. Rail and highway transport tion facilities available. Wage rates are: skilled labor, $1.25 t $1.625 per hour; semi-skilled, 75c.; and common, 55c.

BIDS: Ten bids were received February 9, 1944, rangin from the contract low of $293,218 to $405,799. Awarded Feb ruary 11, 1944.

LIST OF BIDDERS:

1. E. L. Dalton Co., Ltd., and W. G. Cullum, Dallas, Tex. (contract) $293,21
2. Ben Sira & Co., Dallas, Tex 328,73
3. P. C. Sorenson Co., Dallas, Tex 329,42
4. Sherman Machine & Iron Works, Oklahoma City, Okla. 333,36
5. Claud Everett, Inc., Houston, Tex 337,00
6. Leland Fikes, Dallas, Tex 337,2
7. E. H. Reeder Constr. Co., Dallas, Tex 340,53
8. E. E. Farrow, Inc., Dallas, Tex 355,4
9. B. & M. Constr. Co., Oklahoma City, Okla 371,6
10. Peter Kiewit Sons Co., Omaha, Nebr 405,79

Item	Quan	Unit Prices (1)	(2)	(3)
1. 30-in. c. i. water main (Cl. 1) b. & s.	15,127 l. f.	$12.30	$14.00	$14.
2. 30-in. c. i. water main (Cl. 1) mech. joints	354 l. f.	13.30	16.00	15.
3. 20-in. c. i. water main (Cl. 150) b. & s.	87 l. f.	8.10	8.75	8.
4. 16-in. c. i. water main (Cl. 150) b. & s.	9,264 l. f.	5.40	6.00	5.
5. 12-in. c. i. water main (Cl. 150) b. & s.	1,552 l. f.	2.85	4.00	3.
6. 8-in. c. i. water main (Cl. 150) b. & s.	1,504 l. f.	2.15	3.00	2.
7. 6-in. c. i. water main (Cl. 150) b. & s.	161 l. f.	1.50	2.50	1.
8. Cast iron special fittings (400-ft. working pressure)	55 tons	190.00	200.00	210.
9. 30-in. gate valve	1 ea.	2,100.00	1,750.00	2,070.
10. 24-in. gate valves	4 ea.	1,350.00	1,000.00	1,410.
11. 20-in. gate valve	1 ea.	950.00	800.00	987.
12. 16-in. gate valves	5 ea.	210.00	200.00	188.
13. 12-in. gate valves	5 ea.	120.00	120.00	125.
14. 8-in. gate valves	5 ea.	60.00	60.00	62.
15. 6-in. gate valves	29 ea.	37.50	40.00	45.
16. 4-in. gate valves	1 ea.	30.00	30.00	32.
17. Air relief valves	4 ea.	475.00	450.00	626.
18. Fire hydrants	6 ea.	100.00	100.00	100.
19. Class A concrete	28 c. y.	40.00	40.00	45.
20. Class C concrete	25 c. y.	15.00	20.00	22.
21. T. & P. railway crossing	Lump Sum	3,000.00	4,000.00	2,500.
22. 24-in. cast iron main	12 l. f.	10.00	10.00	14.
23. Gravel backfill	30 c. y.	2.50	3.00	3.
24. Replace brick pavement	30 s. y.	6.00	5.00	7.
25. Replace concrete paving	42 s. y.	6.00	4.00	7.
26. Replace asphalt paving	807 s. y.	2.50	3.00	2.
27. Replace surf.-treated pavement	4,885 s. y.	2.50	2.50	2.

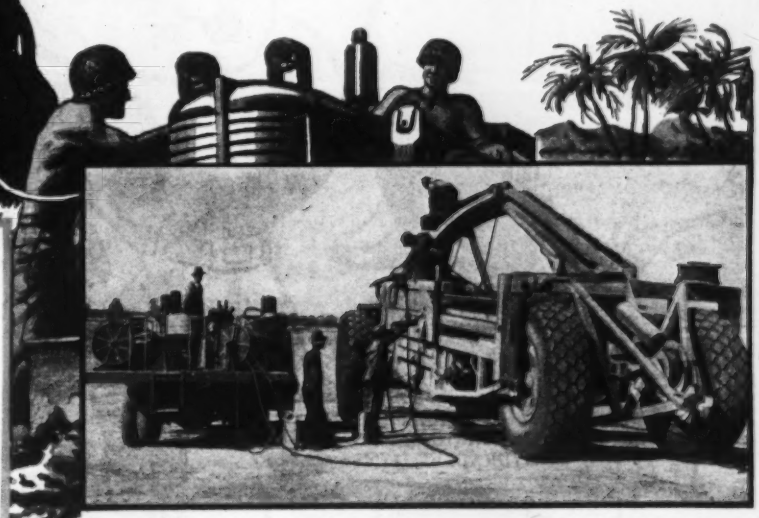
Out of the Pacific Come

NEW WAYS TO CUT YOUR CONSTRUCTION COSTS!

OUT where the heat's on, they're hewing tropical islands into stepping stones to Tokio. It's a tough job, 24 hours a day, 7 days a week. Yet in the doing American ingenuity is finding new ways to cut construction time and costs that *you* can put to good use right now!

From the word "go" the job called for continuous production from every machine. In this battle lost minutes could mean lost men. These machines required the dependable lubrication provided by modern maintenance centers. Such facilities were usually located far from them.

So they brought power lubrication *to* the machines via modern Alemite Portable Service Stations! The savings in machines, man hours and lubricants were so outstanding that, today, the practice is followed on scores of similar jobs.



FACTS FROM THE PACIFIC THAT YOU CAN PROFIT BY!

During an 18 month check, wear on track rollers on "cats" has been reduced by 32% over hand-type greasing.

Due to "barrel to bearing" dispensing, oil and grease consumption has been reduced by 19%.

The equipment serviced includes tractors, bulldozers, caterpillars, shovels, mobile cranes, light plants, trucks, carry-alls, and other machines too numerous to mention.

In one Pacific area, comprising a number of projects, 43 Alemite Portable Service Stations are in continual use.

The equipment is mounted on trucks ranging from one ton to seven ton capacity.

The Alemite Portable equipment includes high and low pressure pumps, gas-driven air-compressors, reels and 50 feet of air hose and light plants for night operation.

All units were assembled on the job according to plans produced by Alemite.

In the Pacific, the jobs had to be done the hard way. Yet here's conclusive proof of savings in manpower, time and machines—a cutting of costs all down the line!

FREE! New catalog illustrating and describing Alemite Portable Service Stations. Write for your copy today!

How the Alemite Portable Service Station Saves Time, Machines and Money!

CONSTRUCTION projects on the home front frequently require irreplaceable equipment to work without let-up far from maintenance centers. Breakdowns, for lack of accurate lubrication are plenty costly in lost time, manpower and machines!

That's why more and more contractors are protecting their vital equipment with Alemite Portable Service Stations. They meet any lubrication need, anywhere, quickly and dependably. And it's a far easier method, saves many man-hours . . . helps get jobs done faster!

The Alemite Portable Service Station is a complete power mobile lubrication department—includes high and low pressure Alemite Barrel pumps, Alemite Motor Oil dispenser, hose reels, and gas engine equipped air-compressor.

For complete information on both standard and custom built Alemite Portable Service Station models . . . for proof of how this equipment *can actually pay for itself in days*, send for your FREE copy of the new Alemite Portable Service Station catalog.

ALEMITE

First in Modern Lubrication

1821 Diversey Parkway, Chicago, Ill. • Belleville, Ontario

Another Product of STEWART WARNER

NEWS OF THE WEEK

(*Continued from p.* 60)

Georgia engineers join the national society

The newly formed Georgia Society Professional Engineers was induct into the National Society of Professio Engineers at Atlanta, March 6.

The charter was presented to Pre dent A. G. Stanford of the Georgia ciety by Harry E. Nold, head of the n tional society, who praised the Georgia for the excellence of their new organiz tion. Mr. Nold also said:

"The war has done much to bring t work of the professional engineers to t attention of the public, and as a resu the confidence of the public in the abil of engineers has greatly increased."

• • •

Mexico gets $10 million credit for oil refinery

The United States, through the E port-Import bank, has extended a $10 000,000 credit to Mexico for the pu chase in the United States of equipmen and supplies required in constructio of a 100-octane gasoline refinery Atzcapotzalco, suburb of Mexico Cit The agreement was signed on March

Petroleos Mexicanos, governmen owned, will take title to the refine when it is built, and Nacional Finan ciera, a bank controlled by the Mexic government, will act as fiscal and pa ing agent in connection with obligatio issued by Mexico. Petroleos Mexican has employed Arthur G. McKee and C engineers of Cleveland, Ohio, to co struct the plant, and has retain Phillips Petroleum Co., Bartlesvill Okla., to give technical advice in co nection with the operation. The Mex can government figures that the enti setup will cost around $12,000,000.

• • •

Concrete barge yard sold at $2 million loss

San Jacinto Shipyard at Port Nech near Houston, Tex., has been sold b the Maritime Commission to the du Po Co., which will build a chemical plant o the site.

Constructed by H. C. Cockburn, Hou ton oil man, who had had neither co crete nor shipbuilding experience, t yard was used for building of only si concrete barges for oil instead of th twenty planned originally. Actual go ernment outlay for the yard construct

THE VILLAGE SMITHY HAD ITS

Supercharger

SUPERCHARGING — Does this word conjure up visions of airplanes far up in the stratosphere? Developed so much by the war, that use, has indeed given superchargers a "lift" and a glamor far above that of ordinary blowers.

The principle of the supercharger is not new, nor limited to augmenting sub-atmospheric pressures. The Egyptians of 1500 B.C. used mechanical blowers in the form of leather bags to produce a fierce fire for metal working. The village blacksmith "supercharged" his forge with what he called a bellows.

The sole function of the bag blower, the blacksmith's bellows or the modern supercharger was and is to burn fuel faster by delivering air of greater density to the point of combustion. With more fuel burned per stroke the diesel, gas, or gasoline engine generates more power. Results:—

Up high — restores sea level power.

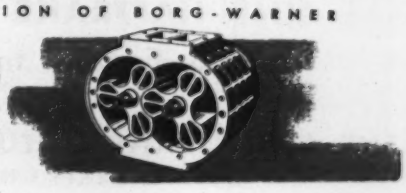
On the ground — gets more power out of an engine and enables a small engine to do the work of a larger one.

It is not too soon to ask McCulloch, pioneers in modern supercharging, to show you how supercharging can step up the power of your internal combustion engines.

A Supercharger gives heavy trucks that extra power over the hills . . . that "lugging" ability for carrying heavier loads faster over any roads.

McCULLOCH ENGINEERING CORP.
Milwaukee 9 Wis.
DIVISION OF BORG-WARNER

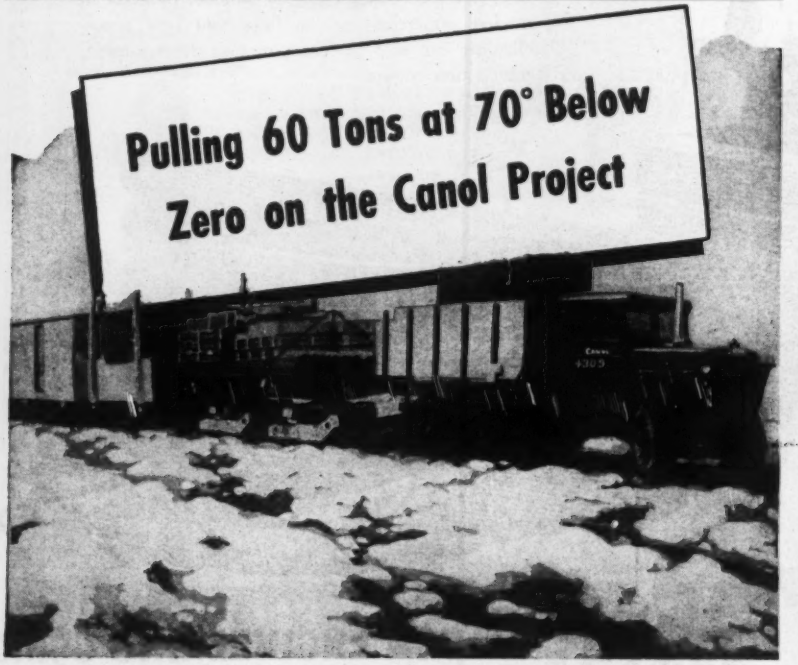
McCulloch's simple design of precision-fitted and sealed impellers insures efficient, service-free supercharging.



So that's one of those bigger pay loads the crane man swears by!
HAISS Hi-Power Digging Buckets in one recent, competitive test showed 40% better efficiency than the next best—due largely to superior design of its closing gear. It pays to say "Haiss"
HAISS
DIGGING BUCKETS

GEORGE HAISS MANUFACTURING CO., INC., 140th St. & Rider Ave., New York 51, N.Y.

Bucket agencies throughout the country Write, wire for prices, delivery or catalogs.



LINN HAFTRAKS show their mettle from the Equator to the Arctic Circle

•

THE LINN MANUFACTURING CORPORATION

MORRIS • NEW YORK

and necessary alterations to make practicable to launch the barges bu was $2,300,000. The sale price of th 40-acre property was $260,000.

The cost of the concrete barges, completed by McCloskey & Co. of Phi adelphia after the original contract w rescinded, was about $1,500,000 so th total cost of each of the barges built San Jacinto was about $2,000,000.

• • •

British plan big liners for postwar commerce

It is reported that two giant ocea liners of the 85,000-ton Queen Elizabe class will be laid down at a cost $40,000,000 immediately after the wa as the start of a ten-year prosperity pla for Britain's shipbuilding industry.

Giving confirmation to this report, S Patrick Joseph Dollan, of the Glasgo Corporation and formerly of the Britis Admiralty, in a speech before the Roya Empire Society in London on March forecast a great shipping boom to follo the war. "Although I cannot reveal m source of information," he said, "I ca say that two new mammoth ships ar on their way.

"All those who know the British shi ping industry are convinced that Britai will make a great effort to retain he command of the seas," he added.

"In 1939," he said, "our gross mer chant shipping tonnage was 18,000,00 about twice the tonnage of the Unite States. It is estimated that after the wa the United States will have 30,000,00 tons against our 10,000,000. We sha need to double that tonnage."

• • •

New lumber controls established by WPB

All consumers of lumber for construc tion—except for construction jobs fo which War Production Board authoriza tion under L-41 specifically makes it un necessary to get WPB permission t start work—must before April 25 fil applications with WPB, giving require ments for the second and third quar ters of 1944. By this means, WPB hope to control consumption of all lumber and, by approving purchase on a ba of relative essentiality, expects to kee consumption more nearly in line wi production than during the past tw years.

This over-all control of consumptio of all species, size and grade is put int effect for the first time, and is outlined in Order L-335. It affects all consumer who use more than 50,000 b.-ft. a quar ter. Applications are to filed on WP Form-3640. The only types of lumbe excepted from the order are certai

What's Behind the Trade Mark?

QUALITY

TRADE MARK

YOUNGSTOWN

SERVICE

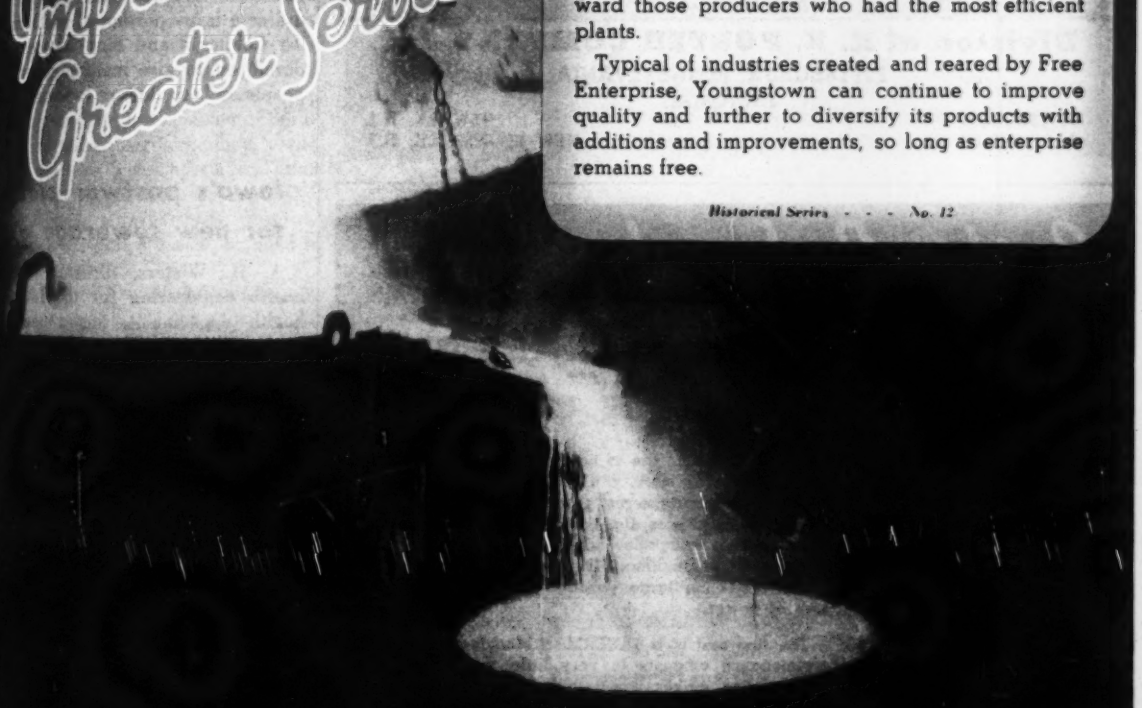
Additions and Improvements for Greater Service

IN the five worst years of the Depression -- 1931 to 1935 -- The Youngstown Sheet and Tube Company spent over twenty-nine million dollars for "additions and improvements." Specifically, this meant new electric weld tube mills, improvements to seamless tube mills, new 79" continuous hot and cold sheet and strip mills, new alloy steel facilities, new thin wall conduit mills, new tin plate mills, blooming mill furnaces, railroad spike and tieplate plants, river coal loading equipment, ore mine improvements and many other projects to improve quality and further to diversify products.

How could Youngstown afford to invest so many millions in new equipment when the economic world seemed desperate? Because of two vitally important things: First, because the company had been permitted -- under a system of free enterprise -- to earn and conserve profits which *could* be spent in bad times. Second, because under free enterprise the company could look forward with certainty to business recovery, when America would need vast quantities of steel again and would reward those producers who had the most efficient plants.

Typical of industries created and reared by Free Enterprise, Youngstown can continue to improve quality and further to diversify its products with additions and improvements, so long as enterprise remains free.

Historical Series - - - No. 12



TAPPING HEAT OF OPEN HEARTH STEEL

YOUNGSTOWN

THE YOUNGSTOWN SHEET AND TUBE COMPANY

YOUNGSTOWN, OHIO

Manufacturers of

CARBON - ALLOY AND YOLOY STEELS

Pipe and Tubular Products - Sheets - Plates - Conduit Bars - Tin Plate Rods - Wire - Nails - Tie Plates and Spikes - Alloy and Yoloy Steels

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SCREW
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CENTRIFUGAL
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√ LESS FRICTION
√ LESS WEAR
√ LESS MAINTENANCE
IT ALL ADDS UP TO . . .
Longer Life!

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QUIMBY PUMP COMPANY
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Division of H. K. PORTER COMPANY, Inc.
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FACTORIES:
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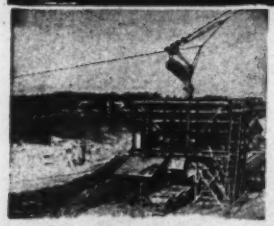


Sauerman Stackline Cableway digs sticky matrix from deep deposit and delivers 70 cu. yd. per hour to car-loading hopper.

Sauerman Tower Machine digs a waste disposal basin 400' wide, 1500 ft. long, on sloping ground; piles the spoil to make a dam at toe of slope.

By the SAUERMAN method of handling materials . .

Where materials are to be moved distances of several hundred feet or more, a SAUERMAN Drag Scraper or Cableway can cut the cost per cubic yard to a low figure because it is able to dig, haul and place the material in a continuous, straightline operation, doing away with the expense of rehandling. The operation is smooth and rapid, producing large yardage with moderate expenditure of power.

The first cost of a SAUERMAN Machine is reasonable, maintenance amounts to very little, and the simplicity of operation makes it possible to place the control of even the largest installation in the hands of one operator. Moreover, the machine is very flexible, hence it is easy to adapt it to the exact needs of different jobs.

GET THIS USEFUL BOOKLET . . .

Typical examples of pit and bank excavation, reservoir cleaning, cut-and-fill work, moving blasted ore, deep dredging, stockpiling and reclaiming, etc., are illustrated in the Sauerman catalog. A copy of this booklet is yours for the asking. Write for it today.

SAUERMAN BROS, Inc.
532 S. CLINTON ST. CHICAGO 7, ILLINOIS

aircraft grades; shingles, lath slabs; edging, trim and certain di sion lumber; hardwood flooring millwork.

WPB anticipates that the required lications will indicate a requirem pattern, upon which it expects to new procedures to be outlined in amendment to the new order before end of the second quarter.

. . .

Canada, U. S. to surve Columbia River power

An international joint commis will undertake a broad survey of water power resources of the Colu river and its tributaries at the req of the Canadian and United States ernments, it was announced recentl Canadian Prime Minister Macke King.

Both American and Canadian e neers and economic experts will w on the study. Recommendation wil made by the commission on how resources of the river system w drains a large portion of southern ish Columbia and four states, ma developed to give maximum servic people on both sides of the border.

. . .

Iowa's postwar plans for new sewerage wo

A. H. Wieters, director of p health engineering for the Iowa health department, has announce proposed $24,000,000 water and s age construction program to be st by postwar planning groups of the

The largest single item is $10,00 for treatment plants in 72 cities. O are: additions to plants in 79 c sewers and treatment in 99 towns; sewer extensions; addition to water supply systems of 69 towns water supply projects, and water extensions.

Wieters said about 70 percen Iowa's urban population live in p with treatment plants. More than the rest live in cities on the Missi and Missouri rivers where pollut not a problem, through Wieters bel sewage should be at least par treated in these places.

. . .

Oklahoma highway me get higher wartime pa

Reorganization of the engineerin partment of the Oklahoma State H way Department with salary incr to hold and attract capable me

increases for common laborers announced recently by H. E. Bailey, highway engineer. The increase for ers of 5 cents an hour will add ap- imately $100,000 a year to the pay Bailey said. The increases will be tive until June 30, 1946, or until onths after the close of the war. e reorganization will result in shift- of forces not used in construction to in preparing plans and survey. The way commission approved a plan to an engineering department force to preparing a $210,000,000 postwar ram.

• • •

lew Canadian labor code equires arbitration

e Dominion of Canada now has a pulsory labor code covering all kers in war industries, an estimated of at least 2,500,000.

ar industries are defined in the under fourteen headings of which 10 is: "Building or construction emolition of projects under a con- or subcontract, intended for the of His Majesty in right of Canada, ding the construction, erection, re- improvement or extension of build- airdromes, harbors, dock yards, a, defence fortifications or other l, military, or air force works." buildings, transportation services, public utilities are also included in classifications.

ompulsory collective bargaining and tration of disputes are provided for r the code, which provides for the g up of a Wartime Labor Relations rd which will deal with all labor- agement questions (wage rates be- left under the existing National War or Board). Strikes and lock-outs are e subject to severe penalties, and ld be practically eliminated, al- gh they will still be possible after ective bargaining efforts have failed a conciliation board report has been re the Minister for 14 days without pletion of an employer-employee ement.

• • •

ydrographic officers re wanted by the Navy

he Navy is seeking men, 25 to 40 s of age, to commission as hydro- phic officers. They will be assigned a fleet survey vessel, or as carto- phic officers on an auxiliary vessel, or amphibious units.

he qualifications are: A college de- e in civil engineering and two years' erience in one or more of the follow-

No laboratory ever exposed wood to more severe test conditions

BANANA ripening rooms are held at temperatures between 56° and 70° F. Humidities are about 95%. Ideal conditions for rapid growth of wood-destroying fungi, but Wolmanized Lumber* is no ordinary wood. It stands up here.

VACUUM PRESSURE impregnation with Wolman Salts* preservative accounts for this unusual ability. Ordinary wood is thus made highly resistant to decay and termite attack—a fact proved by many similar installations of Wolmanized Lumber, in service for many years, in banana ripening rooms.

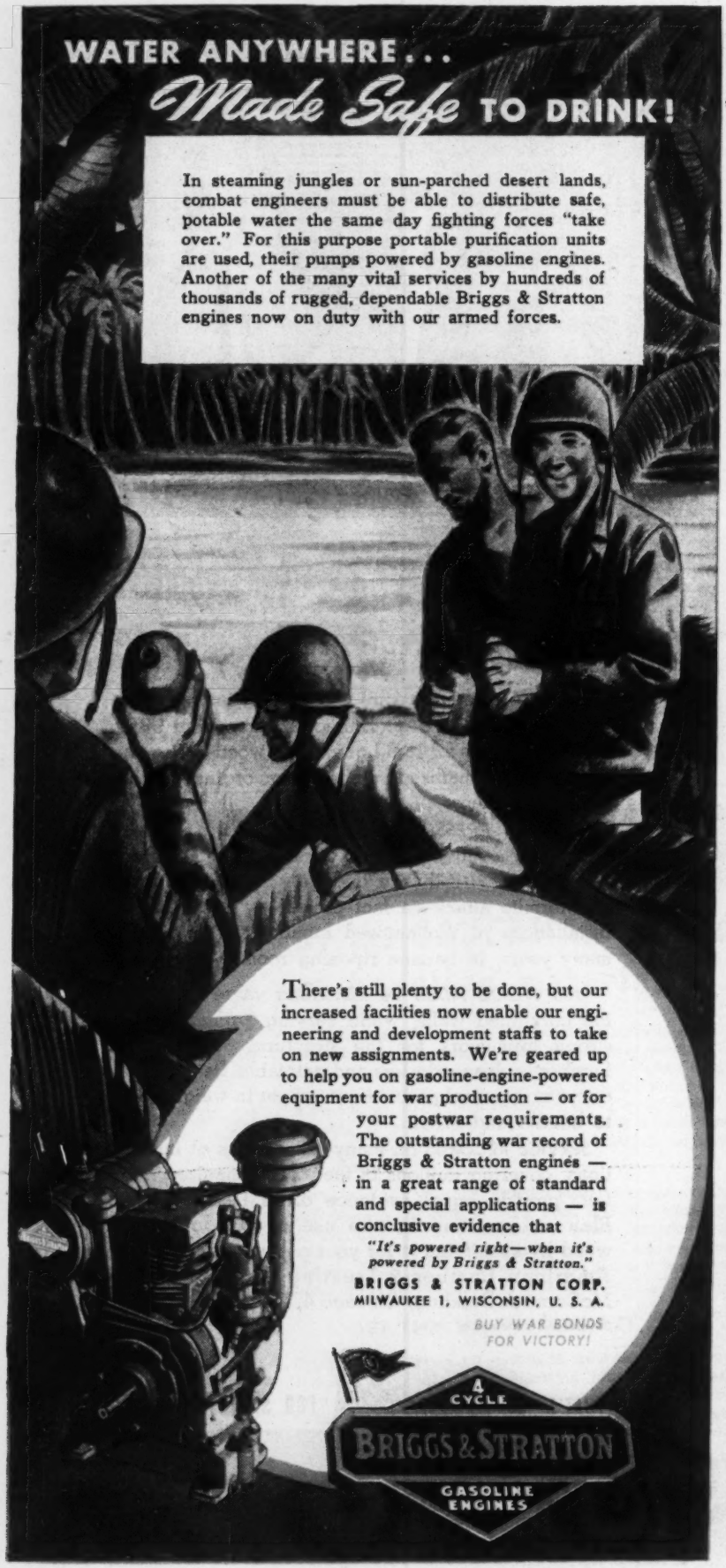
THIS WOOD ADDS its insulating value to that of the cork-lined walls, while serving primarily as a strong framework for the structures. Wolmanized Lumber is clean, odorless and paintable. Its use introduces no unusual problems; it is light in weight, easy to handle and erect.

SERVICE RECORDS on many other types of installations, covering millions of feet of Wolmanized Lumber, provide equal evidence of its lasting ability. Plan on profiting by the use of this long-lived wood by specifying it for your postwar construction. American Lumber & Treating Company, 1649 McCormick Building, Chicago 4, Illinois.

*Registered trade marks

WOOD THAT'S Allowood FOR SAFETY AND ENDURANCE

AMERICAN LUMBER & TREATING COMPANY


WATER ANYWHERE...
Made Safe TO DRINK!
In steaming jungles or sun-parched desert lands, combat engineers must be able to distribute safe, potable water the same day fighting forces "take over." For this purpose portable purification units are used, their pumps powered by gasoline engines. Another of the many vital services by hundreds of thousands of rugged, dependable Briggs & Stratton engines now on duty with our armed forces.
There's still plenty to be done, but our increased facilities now enable our engineering and development staffs to take on new assignments. We're geared up to help you on gasoline-engine-powered equipment for war production — or for your postwar requirements. The outstanding war record of Briggs & Stratton engines — in a great range of standard and special applications — is conclusive evidence that
"It's powered right—when it's powered by Briggs & Stratton."
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BUY WAR BONDS FOR VICTORY!
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BRIGGS & STRATTON
GASOLINE ENGINES

ing: Hydrographic or geodetic sur
ing; land and topographic surveying
mapping; city surveys or mapping
ferably with triangulation; const
tion surveys; and plotting on map
charts, or working up field survey
along any of the above lines.

Lacking a degree, applicants sh
have two years in an accredited co
of engineering, plus four years of p
tical experience in one or more of
above fields, in addition to some tra
or theodolite experience. A knowle
of piloting and navigation would
valuable.

Applications should be made at
Office of Naval Officer Procurement,
Pine Street, New York 5, N. Y., or
other procurement offices in princ
cities.

. . .

U. S. Chamber wants work surveys now

A recommendation that postwar hi
way and airport development progra
be based on comprehensive Fede
State-local surveys of need, and t
states and municipalities carry th
full share of the cost of these proje
will be put before the United St
Chamber of Commerce at its meeti
May 3 to 5 in New York.

The chamber's committee on tra
portation made the proposals at a me
ing of the board of directors Mar.
and they were approved for submiss
to the annual session.

With respect to highways, the co
mittee forecast the need for a comp
hensive rehabilitation and developme
program after the war, and endor
previous chamber approval of Fede
aid for highways of general use, w
adequate safeguards, according
Powell C. Groner, committee chairma

. . .

Thirteen dams planned for Kings River, Calif.

Francis N. Dlouhy, Los Angel
Calif., filed an application March
with the Federal Power Commission
a 36-month preliminary permit to b
thirteen dams on the Kings River a
its tributaries in Fresno County, Calif

In his application, Dlouhy said that
proposed to develop the power resour
of the Kings River basin from the co
fluence of the river and its north fork
the boundary of Kings Canyon Nation
Park. The thirteen dams would crea
reservoirs with an estimated total stora
capacity of 366,100 ac.ft.

The hydroelectric project would a
fect lands owned by the United States
Sierra and Sequoia National Forests.

For large construction projects

TELSMITH

COMPLETE PLANTS

1,500,000 cu. yds. of aggregate for Norfork Dam.

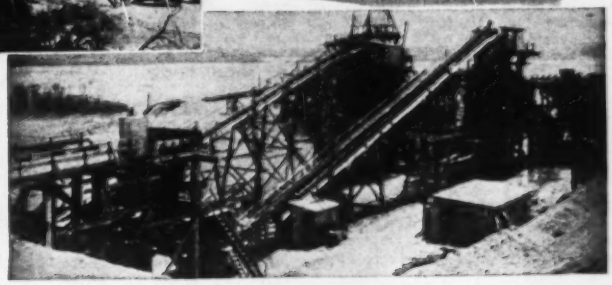
...0,000 tons of aggre-...s for Center Hill Dam.

West Mountain Plant serves many Pennsylvania projects.

...00,000 yds. of aggregate ... Delaware Aqueduct.

● When it's a big job and urgent — there's usually a Telsmith sand and gravel or rock crushing plant. A complete plant, soundly designed by Telsmith engineers—with accurately balanced Telsmith-built machinery . . . completely adequate as to crushing, screening, classifying capacity . . . fast and flexible in operation . . . entirely dependable as to product quantity, quality and sizing. For reasons why—get Bulletin EP-2.

MP-4



Large war projects in New England are served by this Telsmith plant.

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Roanoke Tractor & Eqpt. Co. Roanoke 7, Va.
North Carolina Eqpt. Co. Raleigh and Charlotte, N.C.
Wilson-Weesner-Wilkinson Co. Knoxville 8 and Nashville 6, Tenn.

MATERIALS AND LABOR PRICES

Market quotations on construction materials and wage rates reported monthly by ENR correspondents

LUMBER PRICES and labor rates provided the most important changes in the construction market in April. Short-leaf yellow pine was up in Birmingham, Chicago, New Orleans and New York on most sizes, but it declined 50c. per M ft. b.m., on 1x6-in. sizes in Denver. Douglas fir increased $5.00 to $7.00 on 1- and 2-in. sizes in Chicago, but was $1.00 lower on 3x12-in. and 12x12-in. timbers.

Only minor increases or decreases were reported in other materials for the month.

In Detroit, Philadelphia, New York, San Francisco and Seattle, the W Labor Board approved increased rates for some construction trades. Detr bricklayers' and plasterers' rates climbed 5c. per hour. In Philadelp bricklayers, carpenters and structural ironworkers received 8 to 10c. hour increases. Seattle skilled rates were up 6½ to 8½c. and com labor on building construction rose 6½c. San Francisco common la was up 5c. per hour, and common labor on buildings in New York clim approximately 7c. per hour.

CEMENT, AGGREGATES, READY-MIXED CONCRETE—F.O.B. CITY

	PORTLAND CEMENT — Per bbl., C/L lots, bbl. for bags, cash dis. not deducted			SAND AND GRAVEL — Per ton, carload lots' Gravel,	Gravel		CRUSHED STONE Per ton, carload lots		CRUSHED SLAG Per ton, carload lots, f.o.b. plant		CONCRETE BLOCK 8x8x16-in.; truckload del.; per block		CONC Ready
	Cloth *a*	Paper	Bulk	1½ in.	¾ in.	Sand	1½ in.	¾ in.	1½ in.	¾ in.	Sand-grav.	Lt. wgt. Agg.	1:2:4
Atlanta	$2.77	$2.52	$2.47	$1.79	$1.89	$1.99	$1.79	$1.89	$1.59	$1.69	$0.17	....	$8
Baltimore	2.33	2.08	1.88	1.75‡	1.75‡	1.25‡	1.75‡	1.75‡	1.75‡	1.75‡	.125	$0.125*w*	7
Birmingham	2.50	2.25	2.10	1.75	1.75	1.50	.85	1.00	.90	1.15	.1425	....	8
Boston	2.75*b*	2.40*b*	2.30	1.40‡	1.40‡	1.00‡	1.40‡	1.40‡	....	....	.13	.155*w*	7
Chicago	2.70	2.45	2.30	2.15‡*d*	2.15‡*d*	2.15‡*d*	2.15‡*d*	2.15‡*d*	1.75‡	1.75‡	.16	.16*x*	
Cincinnati	2.31	2.06	1.81	1.20	1.20	1.10	1.80	1.80	....	....	.12	.15*w*	6
Cleveland	2.39	2.14	....	1.70*i*	1.55*i*	1.60*i*	1.73*i*	1.73*i*	1.73*i*	1.73*i*	.14	.15	7
Dallas	2.52	2.27	2.07	1.50*p*	1.70*p*	1.10*p*	1.69*p*	1.79*p*	....	....	.15	....	6
Denver	3.08	2.88	2.32	1.20	1.30	1.25	1.65	1.75	1.00	1.00	.15	....	7
Detroit	2.39	2.14	1.99	1.50	1.50	1.50	2.25	2.25	2.00‡	2.00‡	.14	.14*w*	7
Kansas City	2.58	2.33	2.18	1.85	2.30	1.00	1.91	1.91	....	....	.125	.125*uy*	7
Los Angeles	3.00*v*	2.40*v*	....	1.30	1.30	1.15	1.30*f*	1.30*f*	....	....	.04*bb*	.10*aa*	7
Minneapolis	2.90	2.65	....	1.00*h*	1.00*h*	.25*h*	1.00*h*	1.00*h*	....	....	.12	.16	7
Montreal	....	1.95*rs*	1.79*rs*	....	1.65‡*t*	2.05‡*t*	1.05*ct*	1.15*ct*	....	....	.14*st*	.14*rt*	7
New Orleans	2.41	2.16	1.96	1.65	1.65	.90	....	....	....	....	.19	....	9
New York	2.69‡	2.44‡	....	1.60*ds*	1.60*ds*	.90*ds*	1.70*ds*	1.80*ds*	....	....	.16	.14*wx*	7
Philadelphia	2.33	2.08	1.88	1.55‡	1.65‡	1.20‡	1.90	1.95	1.10	1.10	.155	.155*w*	6
Pittsburgh	2.45	2.20	2.00	1.65‡	1.65‡	1.25‡	2.25‡	2.25‡	1.50	1.50	.17	.17*z*	6
St. Louis	2.80	2.52	....	1.75‡	1.50‡	1.25/1.50‡	1.10*h*	1.10*h*	.75*g*	.75*g*	.13	.15*y*	9
San Francisco	....*u*	2.21	1.91	1.36	1.26	1.26	1.46	1.46	....	....	....	.20*aa*	7
Seattle	2.95*o*	2.75*o*	....	1.00*o*	1.00*o*	1.00*o*	2.00*o*	2.00*o*	....	....	.16	.16*y*	7

‡ Delivered. *a* 10c. allowed for each returnable bag. *b* 10c. per bbl. off for cash. *c* F.o.b. quarry. *d* Per cu. yd. *e* Barge lots alongside docks. *f* Crushed granite. *g* F.o.b. Granite City, Ill. *h* F.o.b. plant. *i* Within three miles of Public Square. *j* 5% discount for cash. *k* Discount of 2 percent for cash in 10 days. *l* Up to 200 cu. yd. *m* 50c. off for cash. *n* 25 c.y. or more. *o* 2% off for cash. *p* 10c. per ton off, cash in 10 days. *r* 10c. per bbl. off, cash 20 days. *s* 8% sales tax included. *t* 8% sales tax not included. *u* Price withdrawn. *v* 20c. per bbl. discount; 20c. allowance for returnable cloth bag. *w* Cinder. *x* Waylite. *y* Haydite. *z* Celocrete. *aa* Pumice. *bb* 4 x 8 x 12 in. *cc* Also 8 x 18 x 18 in.

CASH DISCOUNTS CEMENT to Contractors: truck delivery, 2% for cash on 10th of month; on carload deliveries, no trucking, same as dealer cash discount, 10c. per bbl. for payment within 15 days of date of invoice. Subject discount 10c. per bbl. 20 days in Montreal.

CURRENT MAXIMUM PRICES RECEIVED AT CEMENT MILL

Charge for bags not included. For cloth bags, add 40c. per bbl.; 10c. refund allowed for each returnable bag; for paper bags add 15c. per bbl., not refundable

	Bagged	Bulk		Bagged	Bulk		Bagged
Buffington, Ind	$1.70	$1.65	Ironton, Ohio	$1.60	$1.55	Richard City, Tenn	$1.80
Dallas, Tex. (Inc. 9c. tax)	1.84	1.79	Limedale, Ind	1.70	1.65	Steelton, Minn	1.80
Hannibal, Mo	1.70	1.65	Norfolk, Va	1.75	1.70	Universal, Pa	1.65
Hudson, N. Y	1.75	1.70	Northampton, Pa	1.55	1.50	Waco, Tex. (Plus 9c. tax in Tex.)	1.75
Independence, Kans	1.70	1.65	North Birmingham, Ala	1.70	1.65	Montreal (8% sales tax incl.)	1.68

Discount 10c. per bbl. 20 days

PAVING BRICK, BLOCK, ASPHALT, ROAD OILS—F.O.B. CITY

	PAVING BRICK AND BLOCK — Granite per M. lots of 50,000	Brick per M	Wood per sq. yd.	PAVING ASPHALT Per ton, less than 80 penetration		ASPHALT BINDERS—FLUXES Per gal., 80–300 penetration		CUTBACK ASPHALT Per ton		ROAD OIL Per gal.	ASPHALT EMULSION (Quick-breaking) Per gal.	
	4x4x8 in.	carload lots	16-lb. treat	Tank car	Drums	Tank car	Drums	Tank car	Drums	Tank car	Tank car	Drums
Atlanta	$73.00	$39.35	$2.25	$18.53*e*	$24.62*e*	$0.0740*e*	$0.1309*e*	$0.0807*he*	$0.1348*h*	$0.0676*e*	$0.0826	$0.1
Baltimore	150.00‡	48.00	80.00*m*	15.00*r*	21.00*r*	.06*r*	.09*r*	13.00*r*	23.00*r*	.065*r*	.07*r*	
Birmingham	150.00	48.00	.....	17.95	.....†	.0747	.....†	.0834*h*	.....†	.065	.09	
Boston	80.00	57.00	3.75	14.20	20.00	.....	.....	.....	.....	.....	.....	
Chicago	150.00	55.00	2.50/2.80*d*	14.00	22.50	13.00*g*	21.50*g*	.0575*h*	.15*h*	.05*n*	.09/10*n*	.15
Cincinnati	120.00	50.00	.....	16.40	.....	.085	.....	12.25	.....	.07	.085	
Cleveland	118.00	37.50	2.50	17.00	19.00	.085	.095	.10*h*	.15	.095	.09	
Dallas	.....	36.00	.....	13.65	20.30	.06	.11	16.00	24.80	.06	.05/.07	.07
Denver	.....	66.11	.....	11.00	.....	10.00	.....	.045*h*	.....	.....	.....	
Detroit	.....	37.50	.....	18.06*f*	25.60*f*	.0743	.128	.0718*h*	.119*h*	.067	.0775	
Kansas City	.....	40.00	.....	18.50	23.50	.077	.1075	.077*h*	.107*h*	.057	.11	
Los Angeles	.....	50.00	.....	9.00*b*	23.00	9.50*bg*	24.00*bg*	9.50*b*	.....	.025	.072	
Minneapolis	.....	.....	2.30*d*	.....	27.70	.....	.126	.....	32.64	.....	.....	
Montreal	92.40	.....	.....	16.60*k*	24.25*k*	.116*k*	.1485*k*	.115*hk*	.135*hk*	.08*k*	.135*k*	
New Orleans	.....	.....	.....	13.50*a*	20.00*a*	.057	.088	.06*h*	.095*h*	.....	.080	
New York	.....	65.00	.....	17.40	24.20*p*	14.00	.....	.0725*h*	.1325*hp*	.....	.0725*p*	
Philadelphia	140.00	58.00	4.06	15.00*r*	.....	14.00*r*	.....	.065*hr*	.....	.....	14.00*qr*	
Pittsburgh	135.00	38.75	.....	18.00	23.00	.09	.16	20.00	36.00	.07	.06	
St. Louis	.....	37.00	.....	16.00	22.00	15.00*g*	21.00*g*	.0575*h*	.1213*h*	.648	.0525	
San Francisco	.....	40.00	.....	10.90	21.15	10.90*g*	18.00*gr*	12.90	17.50*r*	9.50*qr*	.0525	
Seattle	.....	60.00*c*	.....	10.90*i*	23.40*i*	.....	20.40*gi*	11.40*i*	.....	.....	.0525*i*	

‡ Delivered. *a* F.o.b. Baton Rouge. *b* Delivered to purchaser's warehouse. *c* 3½x4x8½ in. *d* 2½ in. 12-lb. treatment. *e* Local reduction due to 20% reduction intra-state class freight rates, only Georgia affected. *f* Mexican. *g* Per ton. *h* Per gallon. *i* F.o.b. Martinez. *j* 3x3½x8½ in. *k* Tax included. *p* No sales to thousand. † Available on priority only and quoted specially. *q* No sales except shipments except to armed forces. *r* February 1943 prices, none later available.

Buckeye CABLE control

EVEN the toughest jobs are easier with Buckeye cable controlled tractor equipment. Building roads in trackless swamps or landing strips on snowbound islands is only the proving ground for peacetime superhighway and airport construction now being planned.

With big, cool-running brakes and clutches, cable-saving fairlead action, high leverage controls, gears running in oil, ball and roller bearings, and rugged construction, Buckeye Power Control Units are doing a full wartime job every day on fronts all over the world.

Scientifically designed blade of Buckeye Cable Controlled 'Dozer digs its way in and rolls the load ahead making possible the handling of bigger yardage. Low center of line pull keeps tractor in balance with the full length of crawlers on the ground for maximum traction. Extra high lift and exceptional digging depth provide unusual flexibility.

There is a Buckeye 'Dozer and Power Control Unit for every standard make and model of tractor, each designed specially for the tractor with which it is to be used. Keep your eye on Buckeye on wartime jobs, remember it for your peacetime jobs.

Buckeye Traction Ditcher Co.
Findlay, Ohio

keep your eye on Buckeye

Buckeye

IRON AND STEEL PRODUCTS—BASE MILL PRICES

	STRUCT. SHAPES-PLATE	REINF. BARS ¼-in billet *b*	RIVETS ½-in. structural	WIRE NAILS Base *d*	SHEET PILING Base	STEEL RAILS Per Gross Ton: Standard	Light	Re-rolled	TRACK SUPPLIES: Angle Bars	Std. Spikes *c*	Tie Plates *c*
Birmingham	$2.10	$2.15	$3.75	$2.55	.....	$40.00	$40.00	$39.00	$2.70	$3.00	$2.15
Chicago	2.10	2.15	3.75	2.55	$2.40	40.00	40.00	39.00	2.70	3.00	2.15
Pittsburgh	2.10	2.15	3.75	2.55	2.40	40.00	40.00	39.00	2.70	3.00	2.15
Buffalo	2.10	2.15	.....	.....	2.40	.....	.....	.....	.....	.....	2.15
Cleveland	2.10	2.15	3.75	2.55	.....	.....	.....	.....	.....	.....	.....
Youngstown	.....	2.15	.....	.....	.....	.....	.....	.....	.....	3.00	.....
Detroit	.....	2.27‡	.....	.....	.....	.....	.....	.....	.....	.....	.....
Gulf ports	2.47*a*	2.52*a*	.....	.....	2.85*a*	.....	.....	.....	.....	.....	.....
Pacific ports	2.75*a*	2.80*a*	.....	3.05	2.95*a*	.....	.....	.....	.....	.....	2.30

‡ Delivered. *a* F.o.b. cars dock. *b* Rail steel same as billet prices. *c* Other basing points include Portsmouth, O., Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., and Pacific coast ports, on tie plates alone, Steelton, spikes alone, Lebanon, Pa., Richmond, Va. *d* Add switching charge $1

IRON AND STEEL PRODUCTS—F.O.B. WAREHOUSE, PER 100 LB., BASE PRICE

	STRUCTURAL SHAPES Per 100 lb. base price	REINFORCING BARS* Per 100 lb., ¼ in., base price: 15 tons or over *b* New billet	Rail steel	Add Switch	$/cwt. for Del.	EXPANDED METAL LATH Per 100 sq. yd., carload lots: Std. diamond mesh, 3 4 lb	Std. ribbed 3 4 lb.	WELDED FABRIC REINFORCING— Per 100 sq.yd., carload lots: 4x16 in., No. 5 & 10 wires	4x12 in., No. 8 & 12 wires	6x6 in. No. 6 & 6 wires Per sq. yd	SHEET PILING Per 100 base p
Atlanta	$2.34	$2.40	$2.40	$.02½	$.10	$21.06	$23.00	$1.82	$1.35	$0.1719	
Baltimore	3.70	2.90	2.75	.....	.10	22.50	24.50	1.70	1.27	.1611	
Birmingham	2.10*a*	2.15	2.15	.02½	.10	19.00	21.00	1.80	1.34	.1701	
Boston	3.85	3.51	3.36	$20 C.L	.10	18.50	29.50	1.76	1.31	.1656	
Chicago	2.10*a*	2.15	2.15	.03	.05	21.50	23.50	1.67	1.25	.1575	
Cincinnati	3.68	2.53*cd*	2.53*cd*	.....	.05	19.50	21.50	1.66	1.25	.1566	
Cleveland	2.10*a*	2.15	2.15	.02½	.10	19.50	21.00	1.66	1.25	.1566	
Dallas	4.25	3.17	3.17	.....	....	25.00	27.50	1.93	1.42	.1827	
Denver	4.57	3.33*kl*	3.85	.....	....	26.50	26.50	1.97	1.45	.186	
Detroit	3.65‡	2.52‡	2.52‡	.....	.10	30.00	30.00	1.68	1.26	.1584	
Kansas City	4.19	2.61*cd*	2.61*cd*	.0	.05	24.50	26.50	1.78	1.33	.1683	
Los Angeles	3.65*f*	2.575	2.425	.02½	.05	23.00	27.50	1.93	1.42	.1827	
Minneapolis	3.81‡	2.73	2.73	.0	.10	25.00	27.00	1.80	1.34	.1701	
Montreal	4.00*i*	2.90*i*	2.80*i*	.....	....	26.00*hij*	33.00*hij*	2.25*i*	3.14*i*	.228*i*	
New Orleans	4.229‡*k*	2.52	2.52	.05	.10	19.00	21.00	1.82	1.35	.1715	
New York	3.75	2.76*e*	2.76*e*	.....	.15	17.50	19.50	1.76	1.32	.1665	
Philadelphia	3.66	3.82	....	.....	....	19.50	21.50	1.71	1.28	.1611	
Pittsburgh	2.10*a*	2.15	2.15	.02½	.10	23.00	26.50	1.59	1.20	1503	
St. Louis	3.697	2.74	2.74	.0	.05	28.00	34.00	1.69	1.27	.1602	
San Francisco	4.35	2.825	2.675	.02½	.10	21.00	24.50	1.93	1.42	.1827	
Seattle	2.75*e*	2.80*e*	....	.....	....	34.50	38.50	1.93	1.42	1827	

‡ Delivered. *a* Mill prices. *b* 5–15 tons, add 15c. 1–5 tons, add 25c. Less than 1 ton, add 50c. *c* 20 tons or over Base. *d* Mill price plus freight. *e* dock. *f* Includes delivery in free delivery zone. *g* Less than 1 ton, add 25c.; 1 to 5 tons, add 10c. * High scrap steel prices cut former 15c. differences between billet and rail steel in many mills. *h* List price. *i* Plus Dominion and Province sales tax. *j* August 1942 price; not on market. *k* Quotation on changed basis actual price change. *l* Approximate Denver price out of wholesale stocks, based on Chicago area; not comparable with preceding prices.

PLUMBING, HEATING, WATER, SEWER AND DRAIN PIPE

	C. I. PIPE Per net ton f.o.b. 6 in. to 24 in.*a*	VITRIFIED SEWER PIPE Per foot, std. 8 in., s.s.	Delivered std. 12 in., s.s.	ASTM 24 in.,	C13–35 36 in.,	CLAY DRAIN TILE Per 1,000 ft., carload lots, f.o.b. 6 in.	8 in.	CONCRETE SEWER PIPE Per ft., delivered; ASTM 12 in.	C 14–35 24 in.	WROUGHT STEEL PIPE— Full standard weight, *k* 1 to 3 in., Black %	Galv. %	Butt Weld 3½ to 6 in.: Black %	Lap
Atlanta	$49.66	$0.26*b*	$0.468*bc*	$1.8525	$4.68*c*	$85.00	$128.00	$0.45	$1.642	48.2	54.2	59.7	
Baltimore	53.00	.35	.60	2.65	7.25	160.00	200.00	.50	1.75	65.5	57.5	63.0	
Birmingham	45.00	.275	.495	1.95	5.50	100.00	220.00	.50	1.70	62.2	54.2	59.7	
Boston	55.40	.26	.463	2.07	5.85	.....	.....	.60	.....	....	....	....	
Chicago	54.33	.35	.675	2.70	7.00	100.00‡	150.00‡	.45	1.85	66.0	55.0	64.5	
Cincinnati	53.27	.231	.4455	1.80	5.125	105.00	170.00	.60	1.70	57.1	43.4	54.0	
Cleveland	54.75	.224*rs*	.432*rs*	1.80*rs*	5.125*rs*	90.60	139.40	.36	1.38	68.5	57.5	66.0	
Dallas	56.43	.31	.58	2.25	5.00	90.00	110.00	.46	1.57	59.9	51.9	57.3	
Denver	61.56	.29†	.52†	2.16†	3.00*n*	125.00	200.00	1.00	2.22	58.4	50.4	55.7	
Detroit	54.75	.35	.675	2.70	7.75	135.00	200.00	.40	1.75	57.7	44.0	54.8	
Kansas City	55.73	.315	.39	2.20	5.86	140.00	260.00	.45	1.60	35.9	46.4	46.6	
Los Angeles	68.40	.282†	.508†	2.034†	5.085†	115.50	192.50	1.00	2.00	61.1	50.1	58.6	
Minneapolis	59.00	.275†	.495†	1.98†	5.37†	.....	.....	.90	2.10	64.2	53.2	60.7	
Montreal	67.00	.85*o*	1.50*o*	5.25*p*	8.50*ep*	45.00*m*	64.00*m*	.48*m*†	1.92*m*†	....	....	....	
New Orleans	51.78	.26	.48	1.69	.....	150.00	220.00	.45	1.65	62.4	54.4	58.8	
New York	52.40	.308	.594	2.52	6.45	.....	.....	.60	1.40	64.9	53.9	62.4	
Philadelphia	51.00	.30	.58	2.50	7.50	150.00	225.00	.45	1.75	56.6	42.8	53.6	
Pittsburgh	56.00	.245†	.4725†	1.845†	5.4325	97.80	154.20	.85*q*	2.00*q*	68.5*i*	57.5*i*	66.0*i*	
St. Louis	53.62	.28	.504	2.016	4.50	85.00	220.00	1.25*j*	2.25*k*	56.4	42.6	52.5	
San Francisco	68.40	.3625*d*	.6525*d*	2.61	6.52	115.00	192.50	.58	2.34	45.0	31.0	41.0	
Seattle	70.20	.375	.675	2.70	6.75	84.00	187.50	.51*f*	1.44*f*	....	....	....	

‡ Delivered. †F.o.b. *a* B. & S. class B and heavier, C/L lots, 200 tons and over Burlington, N.J. (base) $49.00. Based on existing freight rates; subject to rate change. Gas pipe and class A, $3 per ton additional, 4 in., $3 per ton additional, 30 in. and larger usually $2 per ton less. *b* Double strength. *c* List to dealer. *d* List. *e* 30-inch. *f* Less 5% for cash. *g* Culvert pipe. *h* Discounts from standard list consumers carload prices, except Pittsburgh prices are f.o.b. mill. Base price $200 per net ton. List prices per ft.; ½ in., 8½c.; ¾ in., 11½c.; 1 in., 17c.; 2 in., 37c.; 2½ in., 58½c.; 3 in., 76½c.; 4 in., $1.09; 6 in., $1.92. 3 percent tax on transporation costs not included. *i* Applies also at Lorain, Ohio, mills. Chicago delivered base is 2½ points on butt, 1½ on lap. Freight is figured from Pittsburgh, Lorain, O., Chicago Dist. Billing is from point producing lowest price at destination. WROUGHT IRON PIPE: Base price and list prices per ft. same as wrought steel pipe. Discount for Pittsburgh base: Butt-weld—1 in. and 1¼ in. black 34, galv. 18; 1½ in. black 38, galv. 18½; 2 in. black 37½, galv. 18. Lapweld—2½ in. to 3 in. black 31½, galv. 14½; 4½ in. to 8 in. black, 32½ galv. 17. *j* Reinforced; spec. C 75–37. *k* Reinforced; spec. C 76–37. *l* Plus sales tax. *m* Tax *n* 27-in. pipe. *o* Less 50%. *p* Less 53%. *r* Truck delivery. *s* Also

. . . Out of Reach . Out of Luck . . .

GOOD roads are as beneficial to the farmer in a business sense as they are to the motorist in a pleasure sense. Almost any rural [illegible]munity that will plan ahead can [illegible] the right T[illegible]ia roads as [illegible]ements.

TIMES HAVE CHANGED BUT NOT THE STORY

In 1930, Barrett published this advertisement championing the cause of the farmer. Yet, despite fourteen years of unprecedented road-building activity, Pearl Harbor found this country with 1,474,445 miles of roads still unsurfaced. This means that in the present crucial war period thousands of people are being denied quick and easy access to major traffic routes.

Actually, all over the country, the plight of the farmer "out of reach and out of luck" is more difficult than ever before. Today, under the stress of accelerated use and unavoidable wartime neglect, even the surfaced "feeder" roads are wearing out and breaking down.

In fact, the problem of secondary roads is one which far-seeing highway officials realize must be dealt with *first* in post-war planning.

Barrett Tarvia is a prime factor in these plans. This famous basic road-building and maintenance material has already proved its practical value to tax-conscious communities in making possible economical construction by local labor — using local materials. The Tarvia field man will gladly give you full details, help you with the development of your post-war program.

THE BARRETT DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 RECTOR STREET, NEW YORK 6, N. Y.

[illegible]w York . . Chicago . . Birmingham . . St. Louis . . Detroit . . Philadelphia . . Boston
[illegible]vidence . . Rochester . . Minneapolis . . Cleveland . . Columbus . . Toledo . . Youngstown
[illegible]racuse . . Buffalo . . Cincinnati . . Bethlehem . . Portland, Me. . . . Bangor, Me.
[illegible]rwood, N. Y. . . Cromwell, Conn. . . Norwich, Conn. . . Savannah, Ga. . . Norfolk, Va.
Canada: THE BARRETT COMPANY, LTD.: Montreal, Toronto, Winnipeg, Vancouver

Barrett Tarvia*

*Trade-mark Reg. U.S. Pat. Off.

LUMBER, TIMBER PLYWOOD—PER M FT., B.M., CARLOAD LOTS F.O.B.

	SHORT LEAF YELLOW PINE AND DOUGLAS FIR — All S. L. Y. P. is No. 2 common or better and for No. 1 N. C. Box. (Prices in Bold Face) — All Fir planks No. 2 common, Fir timber is No. 1 common. Lengths up to 20 ft. (Prices in italics)								LONG LEAF Y. P. Merchantable grade up to 20 ft.		PLYWOOD Rail freight increm (See note for base p
	1x6 [a,g]	1x8 [a,g]	2x4 [a,g]	2x6 [a,g]	2x8 [a,g]	2x10 [a,g]	3x12 [a,g]	6x12 [a,g]	12x12 [a,g]	2x12 [a,g]	12x12 [a,g]	¾"
Atlanta	$37.00	$37.00	$32.00	$31.00	$31.00	$34.50	$46.00	.....	.....	$54.00	$64.00	$17.90
Baltimore	42.00	45.00	42.00	42.00	43.00	48.00	65.00	.....	.....	115.00	120.00	18.25
	48.00	*48.00*	*55.00*	*55.00*	*55.00*	*55.00*	*68.00*	*$70.00*	*$70.00*	.....	.....	.....
Birmingham	45.00	45.00	44.50	43.50	44.50	47.50	68.00	63.00	67.00	.....	.....	17.35
[j]	50.00	50.00	49.50	48.50	49.50	52.50	72.00	----	----	67.50	70.00	----
Boston ‡*	42.00[3]	45.00[3]	55.00[3]	60.00[3]	60.00[3]	65.00[3]	68.00[3]	.....	.....	72.00[3]	72.00	18.25
‡*	*50.00*	*50.00*	*55.00*	*60.00*	*65.00*	*65.00*	*72.00*	*72.00*	*72.00*	.....	.....	----
Chicago	54.00	54.00	55.00	54.00	54.00	60.00	68.00	.....	.....	80.00	95.00	14.60
	55.00	*55.00*	*54.00*	*54.00*	*54.00*	*55.00*	*66.00*	*66.00*	*67.00*	----	----	----
Cincinnati	47.50	49.00	42.50	42.50	42.50	44.50	67.00	----	----	65.00	65.00	17.35
	.....	.....	.....	.....	.....	.....	.....	.....	.....	----	----	.....
Cleveland	42.50[b]	42.50[b]	52.50[b]	51.00[b]	65.00	65.00	83.00	83.00	83.00	----	----	17.75
Dallas [e]	45.25	45.25	44.50	43.00	43.00	47.25	60.75	58.75	58.75	88.50	88.00	14.60
Denver ‡	63.50[4]	62.00[4]	65.00[4]	65.00[4]	65.00[4]	66.00[4]	69.00[4]	*83.00*	*89.00*	.....	.....	10.45
Detroit	61.00	61.00	57.75	57.75	57.75	62.75	72.75	75.00	90.00	70.75	90.00	17.35
	57.00	*57.00*	*57.00*	*57.00*	*62.75*	*63.75*	*71.00*	*75.00*	*75.00*	.....	.....	.....
Kansas City [a]	64.00	64.00	62.00	60.50	62.00	64.00	79.00	.....	.....	79.00	89.00	12.60
	60.00	*60.00*	*58.00*	*58.00*	*58.00*	*58.00*	*75.00*	*80.00*	*80.00*	----	----	.....
Los Angeles [a]	*60.00*	*60.00*	*60.50*	*60.75*	*59.25*	*59.25*	*73.75*	*73.00*	*73.00*	----	----	9.90[ph]
Minneapolis [b]	59.00[3]	59.00[3]	.....	.....	.....	.....	.....	.....	.....	----	----	12.60
‡	*56.50*	*56.50*	*55.75*	*56.00*	*55.00*	*58.25*	*63.25*	*62.00*	*62.00*	.....	.....	----
Montreal †[7]	*58.00*	*61.00*	*54.00*	*58.00*	*60.00*	*68.00*	.....	.....	.....	220.00	220.00	----
	54.00	*54.00*	*57.00*	*57.00*	*57.00*	*58.75*	*62.00*	*62.00*	*62.00*	.....	.....	.....
New Orleans	40.00	40.00	37.00	35.00	34.00	36.00	46.00	.....	.....	55.00	69.00	14.60
	31.00	*31.00*	*33.00*	*31.00*	*34.00*	*32.00*	*33.00*	.....	.....	.....	.....	.....
New York	67.50	67.50	62.50	62.50	62.50	64.00	74.00	.....	.....	120.00[f]	125.00[f]	18.35
‡	.....	.....	*65.00[i]*	*65.00[i]*	*65.00[i]*	*65.00[i]*	[Range from $75 to $95]			.....	.....	.....
Philadelphia	65.00	70.00	70.00	70.00	70.00	70.00	75.00	.....	.....	130.00	130.00	18.25
	70.00	*75.00*	*70.00*	*70.00*	*70.00*	*70.00*	*85.00*	*90.00*	*90.00*	.....	.....	.....
Pittsburgh	50.80	53.20	62.75	55.00	60.85	62.50	76.25	.....	.....	.....	----	18.10
	69.20	*68.10*	*68.10*	*65.30*	*65.20*	*65.65*	*88.75*	*88.75*	*88.75*	.....	.....	.....
St. Louis ‡c	56.00	56.00	53.00	52.00	52.00	55.00	69.00	*75.00*	*75.00*	86.00	85.00	14.60
San Francisco [d]	*36.50*	*36.50*	*35.50*	*35.75*	*34.75*	*34.75*	*38.50*	*38.00*	*38.00*	.....	.....	7.30[g]
Seattle	*35.00*	*35.00*	*35.00*	*35.00*	*35.00*	*35.00*	*40.00*	*40.00*	*40.00*	.....	.....	0.00

Bold Face type, Southern Pine. *Italics, Douglas Fir.* [1] Long leaf. [2] Roofers' N. C. Pine. [3] Spruce. [4] Native. [5] Western Pine, No. 3 Common. [7] Spruce. [8] Norway Pine. ‡ Delivered. *a* Yard prices. *b* Contractors discount in Minneapolis and St. Paul discontinued May 21, 1938. *c* 5M ft. or less. *d* F.o.b. cars San Francisco freight rate. *e* 10% discount taken off. *f* Up to 18 ft. † Plus sales tax. * Prices for truck delivery; no longer quoting carload lots f. o. b. city.

Note: Special concrete form grade Fir Plywood, 4' by 8' panels, 5-ply, [illegible] 2 sides, water resistant glue, carload lots, delivered per 1,000 sq. ft. [illegible] Seattle base price on ¾", $95.15; on ⅝", $104.85; price includes oiling and [illegible] ing charges. For other centers add rail freight increment from table or p[illegible] size. For resin dipped treatment, add $10.50 per M. *g* Lower rate by w[illegible] shipment. *h* 50,000 lb. minimum. *i* Ranges from $65 to $69. *j* Average p[illegible] *k* August 1943 price. *l* September price; none later available.

GLASS, EXPLOSIVES, CHEMICALS

	WINDOW GLASS — Discounts from jobbers list, Aug. 15, 1938 — Single or Double Thickness A quality	B quality	EXPLOSIVES — Per lb. 40% Ammonia Gelatin in 50-lb. cases delivered in 200 lb. lots*	
Atlanta	75%	75%	$0.15	
Baltimore	78%	79%	.15	
Birmingham	76%	76%	.105	
Boston	77%	78%	.15	
Chicago	77%	77%	.15	
Cincinnati	77–10%	77–10%	.15	
Cleveland	77–10%	77–10%	.19	
Dallas	76%	76%	.1625	
Denver	76%	76%	.155*e*	
Detroit	77%	77%	.1575	
Kansas City	77–10%	77–10%	.155	
Los Angeles	86%*d*	88%*d*	.1575	
Minneapolis	77%	77%	.155	
Montreal	40–10–5*ab*	40–10–10*ac*	.1675†	
New Orleans	70%	75%	.16	
New York	81%	82%	.22*f*	
Philadelphia	78%	79%	.15	
Pittsburgh	79%	79%	.1225	
St. Louis	77–10%	77–10%	.155	
San Francisco	66%	73%	.155	
Seattle	75%	75%	.1575†	

Price of 60% Ammonia Gelatin in $0.01 per lb. higher than 40%

a Discount from list Sept. 1939; sales tax included, but 6% tax exemption not allowed for. *b* Single thickness. *c* Double thickness. *d* Discount from jobbers' list Sept. 15, 1928.

* Urban prices influenced by service charges or local storage and delivery regulations, do not consistently reflect quantity prices in less congested areas. *e* F.o.b. Louviers, Colo. *f* In boroughs of Kings, Queens and Richmond, and in Manhattan south of Canal St. add delivery charge of $6.00 per trip † F.o.b.

40% Ammonia Gelatin price ranges in other than urban areas, per lb. (except Seismograph Grades)

	C/L 20,000 lb. net	Tons	200 lb. lots
E. of the Miss., except Fla. and Me.	$0.105	$0.13	$0.15
W. of Miss. to Rocky Mtn. States, Fla. and Maine.	.11 –.1175	.135 –.1475	.155 –.1675
Rocky Mtn. States	.11 –.1225	.135 –.1525‡	.155 –.1725‡
Pacific N. W. States	.1075–.12	.1375–.15	.1575–.17
Pacific S. W. States	.1050–.1125	.135 –.1425	.155 –.1625

‡ F.o.b. Louviers, Colo., or Butte, Mont.

PILES, TIES—F.O.B.

PILES

Prices per linear foot, fir and pine, bark on, f.o.b. cars, New York. Fir [illegible] on Wash. and Ore. points to New York shipping area; pine based on freight [illegible] Norfolk.

Dimensions	Points	Length	By Rail — Pine*	Fir
12-in. at butt	6-in.	30 to 50-ft.	$0.34	...
12-in.— 2-ft. from butt	6-in.	50 to 59-ft.	.35	...
12-in.— 2-ft. from butt	6-in.	60 to 69-ft.	.36	...
12-in.— 2-ft. from butt	6-in.	90 to 100-ft.	....	.3[illegible]
13-in.— 3-ft. from butt	5-in.	91 to 100-ft.	....	.3[illegible]
14-in.— 2-ft. from butt	6-in.	50 to 69-ft.	.41	.4[illegible]
14-in.— 2-ft. from butt	6-in.	70 to 79-ft.	.43	.4[illegible]
14-in.— 2-ft. from butt	5-in.	80 to 85-ft.	.53	...
14-in.— 2-ft. from butt	5-in.	85 to 89-ft.	.56	...
14-in.— 2-ft. from butt	5-in.	90 to 100-ft.	....	.6[illegible]

* Pine piling over 80-ft. available only in limited quantities.

RAILWAY TIES

Prices f.o.b., per tie for carload lots:		6"x8"x8' Untr.	6"x8"x8' Tr.	7"x9"x8' Untr.	7"x9"x8' Tr.
Boston	Oak	$1.50	.....	$2.00	.....
	Pine	2.00	$3.00*a*	2.50	$3.[illegible]
New York	S. L. Sap Pine	1.43/1.54	2.59	1.76	2.[illegible]
	Mixed Oak	1.71	2.59	2.42	3.[illegible]
Birmingham	White Oak	1.00	1.60*a*	1.30	2.[illegible]
Chicago	Red Oak	....	2.19*a*	2.87	3.[illegible]
Los Angeles	Douglas Fir	2.00	3.25*a*	2.90	4.[illegible]
Philadelphia	Red Oak	....	2.10*ag*	....	3.[illegible]
St. Louis	White Oak	1.48	....	2.04	....
	Red Oak	1.48	2.05*a*	2.04	2.[illegible]
	Sap Pine or Cypress	1.55	....	1.91	....
San Francisco	Douglas Fir	1.25*bf*	....	....	3.[illegible]
Montreal	Birch or Maple	.85	.95	....†	....

Tr.— Treated; Untr.— Untreated. *a* Creosoted *b* 6"x8"x8'6". *c* [illegible] cell. *d* Zinc. *e* Green. *f* F.o.b. cars. † Out of market. *g* January 1943 [illegible] none later available.

CHEMICALS

Water, sewage treatment, road work, f.o.b. carlots, New York

Bleaching powder, in drums, f.o.b. works, per 100-lb.	$2.30–[illegible]
Chlorine cylinders, liquid, per lb. delivered	.[illegible]
Calcium chloride, 77–80%, flaked, 100-lb. paper bag, del'd, ton	13.50–[illegible]
Silicate of soda, 52 deg., in drums, f.o.b. works, per 100 lb.	1.[illegible]
Soda ash, 58%, in paper bags, per 100 lb. dense	2.20–[illegible]
Sulphate of aluminum, commercial, in 100-lb. bags, per ton	[illegible]
Sulphate of copper, in bbl., per 100-lb	[illegible]

WHEN THE KICK OF A MULE

is all to the good

(THE CHRYSLER "SEA MULE")

WHEN a ship of war or a cargo vessel carry its own tug with it, hoist it over the side, to work the ship into its own docking position — 's a mule kick that's all to the good.

when a barge loaded with a war cargo can be rtly maneuvered in a difficult channel, or be ed up the streams and rivers of an invaded shore— s another mule kick that firmly writes itself into ry.

are the exploits, and such is the current history, e "Sea Mule" of Chrysler Corporation design and uction. This "Sea Mule" in various sizes and models and with the stalwart power of its Chrysler marine engines, has played its part in the work of the Navy, and helped the Army in all parts of the world.

Production of these harbor tugs in large numbers is another of the vital war jobs in which Chrysler Corporation is applying its resources in creative engineering and quantity manufacturing.

TUNE IN MAJOR BOWES EVERY THURSDAY, CBS, 9 P. M., E. W. T.

CHRYSLER CORPORATION

PLYMOUTH • DODGE • DE SOTO • CHRYSLER

CHRYSLER Marine and Industrial Engines

AIRTEMP Heating, Cooling, Refrigeration OILITE Powdered Metal Products

LET'S ALL BACK THE ATTACK — BUY MORE WAR BONDS

STRUCTURAL CLAY BUILDING TILE, BRICK AND LIME—DELIVERED

	STRUCTURAL CLAY TILE—PARTITION—SCORED Per M. lots of 2,000 pieces or over, 3x12x12 in.	4x12x12 in.	8x12x12 in.	STRUCTURAL CLAY TILE—LOAD BEARING—SCORED Per M. lots of 2,000 pieces or over, 8x12x12 in.	10x12x12 in.	12x12x12 in.	BRICK Per M. in quantity. Common backing	Straight hard	LIME Per ton, Hydrated finishing	In paper, Common hydrated	Carlots, Pulverized or lump
Atlanta	$104.00	$114.00	$199.00	$234.00	$244.00	$250.00	$13.50	$18.04	$26.54	$15.04	$15
Baltimore	84.00	90.00	170.00	200.00	260.00	300.00	15.90*k*	19.00*k*	18.00	13.00	2
Birmingham	80.00	85.00	160.00	191.00	252.00	288.00	14.50	17.00	18.11	13.64	2
Boston	89.35*a*	93.30*a*	178.70*a*	202.50	271.80	308.70	16.50*i*	19.50*i*	17.50†	12.50†	14
Chicago	72.00	77.00	145.00	197.00	243.00	278.00	12.50	13.50	17.00	15.00	12
Cincinnati	65.55	69.90	131.20	148.70	210.35	240.45	22.00	22.00	15.50	13.00	
Cleveland	60.00	64.00	120.00	144.00	193.00	221.00	17.00	17.00	15.75*j*	13.25*j*	1
Dallas	62.50	67.50	135.00	162.00	212.50	263.00	13.50*i*	15.00*i*	19.00	15.00	13
Denver	84.80	95.40	153.70	178.20	212.00	227.90	14.50	18.00	25.00*j*	17.00*j*	20
Detroit	86.05*x*	91.80*x*	172.10*x*	213.00*x*	268.00*x*	311.60*x*	20.00	21.00	18.00	16.00	16
Kansas City	67.00	69.00	89.00*c*	128.00	163.00	189.00	14.50	15.50	19.32	13.00	16
Los Angeles	73.50†*r*	89.50†*r*	128.00*c*†*r*	210.00†*r*	368.00†*r*	460.00†*r*	13.50	15.00	16.50	17.50	17
Minneapolis	81.95*b*	87.40*b*	148.70*b*	.....	179.30*b*	249.35*b*	13.60	15.60*g*	21.00	16.00	19
Montreal	94.55*a*	100.45*a*	199.50*a*	160.45*a*	109.40*at*	137.40*at*	21.08†*u*	28.35†*u*	24.60*u*	18.00*u*	
New Orleans	72.00	72.00	135.00	162.00	210.00	260.00	14.00	.....	18.30	12.08	14
New York	78.40	83.60	115.00*c*	193.30*h*	238.80*h*	295.60*h*	16.50/17.50	.....	20.00	14.00	17
Philadelphia	85.30	91.00	170.50	204.60	252.00	312.00	17.00	20.00	19.00	16.00	19
Pittsburgh	62.35	66.55	124.75	140.25	173.25	198.00	17.50	19.50	17.90	15.40	2
St. Louis	67.00	95.00	130.00	190.00	244.00	290.00	18.00	17.00	22.00	18.00	2
San Francisco	96.00	108.00	144.00	.....	.....	.....	19.00	.....	24.00	23.00	2
Seattle	115.00	125.00	230.00	.....	.....	.....	20.00*f*	21.00*f*	20.00*s*	20.00*s*	20

† F.o.b. *a* Smooth. *b* Carload lots delivered to job. *c* 6x12x12 in. *d* Not load bearing. *e* 48 lb. tile. *f* Less $1.00, ½ cash 15 days, balance 30 days *g* Selected common. *h* F.o.b. Perth Amboy, N. J. *i* F.o.b. Warehouse only. *j* LCL *k* $1.00 discount if paid in 10 days. *l* Lump. *m* Per bbl., 180 lb. *o* Per bbl., 200 lb. *p* 280 lb. bag. *r* 5% discount 10 days. *s* 2% disc cash. *t* 5½x8x12. *u* 8% sales tax included. *v* 6x12x12-in. *w* Per 200 *x* Prices also apply for Dec. and Jan.; market in Detroit unsettled; Tile

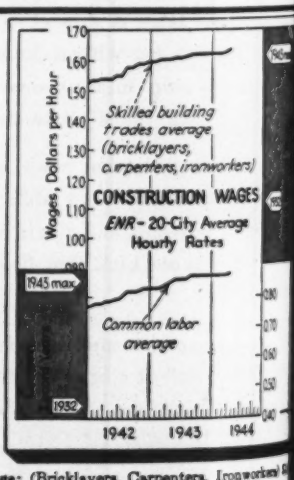
PAINT, ROOFING—F.O.B. CARLOAD LOTS

	RED LEAD Per 100 lb. in 600-lb. (Approx.) bbl. Dry *a*	WHITE LEAD Per 100 lb. in oil	READY-MIXED PAINT Per gal., drums Graphite *b*	Aluminum *b*	Ferric Oxide *d*	ROOFING SUPPLIES Carload lots f.o.b. factory— Rolls, slate surfaced, 85–90 lb. per sq.	Asphalt felt, per 100 lb.	Tar felt, per 100 lb.	Asphalt coating per gal.	Tar 350 lb. per
Atlanta	$10.25	$14.125	$1.30	$2.25	$1.20	$1.90	$1.61	$1.61	$0.27	$
Baltimore	10.00	13.75	2.00	3.00	2.50	2.30	2.70	2.70	.40	
Birmingham	10.25	14.125	2.35	3.50*r*	1.98*r*	2.04	1.97	1.97	.32	
Boston	10.00	13.75	1.65	....	2.30	2.05‡	1.60*h*‡	1.60*h*‡	.50‡	
Chicago	10.00	13.75	....	....	....	1.75*h*/*f*	1.74*h*/*f*	1.82*h*/*f*	.33/*f*	
Cincinnati	10.00	13.75	1.70	2.90	1.60	2.40	2.39*h*	2.39*h*	.36	
Cleveland	10.00	13.75	1.70	2.90	1.60	1.93	1.83*h*	1.83*h*	.35	
Dallas	10.00	14.50	1.88	2.11*n*	.05*l*	1.75*h*	1.66*h*	1.66*h*	.35	
Denver	10.50	14.25	....	14.25*k*	.27*l*	2.45	2.95	2.95	.35	
Detroit	10.00	13.75	1.75	3.00	1.60	2.25	2.25	2.25	.50	
Kansas City	10.00	13.875	2.30*g*	2.55*gr*	2.16*g*	2.10	2.30	2.30	.28	
Los Angeles	10.25	14.25	1.60	2.25	2.30	2.10	1.50	....	.45	
Minneapolis	10.00	13.875	....	....	....	1.75*i*	1.66*h*‡	1.66*h*‡	.32	
Montreal	9.25	6.25	2.50*p*	4.90*p*	3.15*p*	4.02*t*	2.58*t*	3.01*t*	.89*t*	
New York	10.00	13.75	2.03	....*r*	1.64	1.66	1.58*h*	1.58*h*	.26	
Philadelphia	10.00	13.75	1.60/1.80	2.20*r*	1.55	1.75	1.66	1.66	.32	
Pittsburgh	10.00	13.75	1.05	1.95	.80	1.95	1.94*h*	1.94*h*	.34	
St. Louis	10.00	13.75	2.28*a*	2.89*a*	1.96*a*	1.66	1.66	1.66	.28	
San Francisco	10.25	14.00	1.80	2.75*n*	1.35	1.71	2.40	2.40	.33	
Seattle	10.25	14.25	1.90	3.00	....	2.15	2.16*h*	....	.35	

‡ Delivered. Note: Red lead in oil 50c. higher than white lead in oil. *a* Red lead prices change frequently due to pig lead price changes. *b* U. S. War Dept. Spec. 3-49A. *c* ASTM Spec. D266-31. *d* 80% minimum ferric oxide. *e* Subject to 25% discount. *f* Distributors' price to contractors. *g* 5 gal. can. *h* Per roll, 65 lb. *i* Minneapolis and vicinity. *j* Asphalt pitch. *k* Per *l* Per lb. *m* Per bbl. *n* May, 1941 price, no later quotation available. *p* 8% sales tax. *r* Not available, except on priority rating; then quoted *s* December, 1942 price. *t* Federal tax included.

SKILLED AND COMMON WAGE RATES—PER HOUR

	Bricklayers	Carpenters	Struct. Iron Workers	Hoisting Engineers	Plasterers	Common Labor—Building	Common Labor—Heavy Const.
Atlanta	$1.50	$1.25	$1.50	$1.25	$1.50	$0.40	$0.50
Baltimore	1.75	1.375	1.80	1.625/1.80	1.50	.75	.75
Birmingham	1.75	1.25	1.50	1.25/1.50	1.50	.65	.65
Boston	1.625	1.50	1.65	1.875	1.667	.80/1.00	.80/1.00
Chicago	1.75	1.70	1.76	1.75	1.825	1.10	1.10
Cincinnati	1.75	1.50	1.675	1.45/1.60	1.625	.85	.85
Cleveland	1.875*c*	1.575	1.875	1.875	1.875	1.085	1.15/1.25
Dallas	1.625	1.25	1.50	1.75	1.625	.60	.75/1.25
Denver	1.65*b*	1.50*b*	1.50*b*	1.50/1.625*b*	1.50*bf*	.80*b*	.80*b*
Detroit	1.725*df*	1.50	1.75	1.675/1.75*df*	1.725*df*	.90	.75/.90*df*
Kansas City	1.65	1.50	1.625	1.625	1.65	.90	.90
Los Angeles	1.50	1.35	1.625	1.375	1.667	.875	.875
Minneapolis	1.50	1.375	1.50	1.40	1.50*e*	.925	.925
New Orleans	1.50	1.25	1.50	1.50	1.375	.65	.75
New York	2.00*b*	1.85*b*	2.00	2.00*b*	2.00*b*	1.10*f*	.95
Philadelphia	2.00*f*	1.58*f*	2.00*f*	2.00	2.00	.825	.825
Pittsburgh	1.90	1.75	1.75	1.8125	1.875	.90	.80
St. Louis	1.75	1.50	1.75	2.00	1.75	.95	.95
San Francisco	1.875	1.50	1.75	1.50/1.75	1.75	1.00*f*	1.00*f*
Seattle	1.845*f*	1.565*f*	1.745*f*	2.00	1.865*f*	1.145*f*	1.10
Montreal*	.98	.87	.96	.82	.96	.52	.59



b 7 hr. day. *c* Prevailing rate on government work. *d* Rates effective Mar. 1, 1944. *e* 35 hr wk. *f* Rate change in Detroit, Philadelphia, New York and Seattle approved by W.L.B. * Cost of living bonus now included in basic wage.

ENR Skilled Average: (Bricklayers, Carpenters, Ironworkers) **ENR Common Average:** $0.874

RIGHT DRESS ...FOR TOMORROW

When Johnny and his buddies come marching home, it's up to every community to have plenty of big jobs for their own men to do. One sound way to insure the future of your local citizens is to plan important public works projects NOW—projects which will give your men the steady employment they'll need during the period of "war-to-peace conversion."

The manufacture and installation of Lock Joint Concrete Pipe for your water supply lines, sewerage and drainage programs provide one of the best methods for putting your local men to work quickly—right in your own home town. Past experiences have proven that by erecting temporary local plants as much as 90% of your local labor can be used in building these dependable and economical pipelines. In addition, the Lock Joint Pipe Company buys the bulk of supplies and materials from your own merchants—and thus, most of the cost of the project remains in your community.

Whether your project is large or small, for the present or the future, your 'phone call, telegram, cable or letter to any of our offices will bring a prompt reply.

LOCK JOINT Reinforced Concrete PRESSURE PIPE

LOCK JOINT PIPE COMPANY

Established 1905

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SCOPE OF SERVICES *Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply Mains as well as Concrete Pipe of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous lines.*

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SIMPLE DESIGN
Easy Operation
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ECONOMICAL
—to operate
—to maintain

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SINGLE-ACTING
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Drive wood, concrete, or steel piles this low-cost, dependable way. For almost 55 years the Warrington-Vulcan has been demonstrating its great ability on many important jobs in the United States and other countries. It operates at a medium steam pressure and delivers a moderate frequency of low velocity blows from a relatively heavy ram. Free from mechanical troubles, you are assured of regular and continuous action. Write for complete details.

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NEW AIDS TO THE CONSTRUCTOR

Wire Rope Clamp

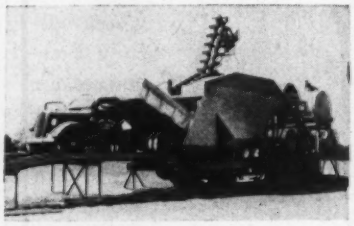
Four new sizes of "Safe-Line" wire rope clamps have been added to the manufacturer's line. This makes a total of clamps in 13 sizes, ranging from 1/16 in. to ¾ in.

Said to have tremendous holding power, the clamp consists of only four parts; two taper threaded sections, placed on the exposed sides of the wire rope, which squeeze together in a vise-like grip when two taper nuts are tightened. A patented feature of the clamp is inside grooving to fit the rope.—*National Production Co., Safe-Line Clamp Division, 4561 St. Jean Ave., Detroit 13, Mich.*

• • •

Portable Batching Plant

Elimination of considerable handling equipment and reduction of the number of mixing units per concrete yard mile are among the advantages claimed for a new portable batching plant. This



"Porto-Batcher" unit, to be towed behind a truck, can be quickly set up for operation. The unit features a charging skip of 43 cu. ft. capacity (33 cu.ft. for aggregate and 10 cu. ft. for cement) for proper intermingling of the materials, and this is said to provide excellent pre-mixing and pre-shrinkage.

The Porto-Batcher has pneumatic tired wheels. All levers are grouped in one central location, permitting one-man control of all batching operations. The batching cycle is 90 seconds.—*The C. S. Johnson Co., Champaign, Ill.*

• • •

Engine-Driven Arc Welder

Light in weight and of rugged construction, a new engine-driven "Shield-Arc" welder has a powerful enclosed, rubber-mounted 29 hp. engine. This new unit, with base and canopy, weighs approximately 1,130 lb., is 65¼ in. long, 24 in. wide, 41½ in. high, and has

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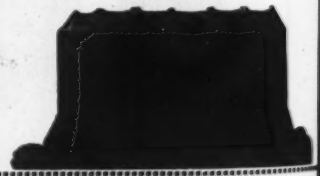

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The daily total of ton-miles and passenger-miles demanded of trucks, buses and taxis today is terrific . . . imposes an enormous load on lubrication.

That's why you need the plus qualities of Quaker State HD Oil . . . to keep your engines running smoother, cleaner, longer. It resists oxidization and the formation of sludge, varnish, and corrosive acids. Try Quaker State HD Oil in your equipment, and you, too, will find "It's the OIL that Carries the Load."

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FOR OPEN STEEL FLOORING AND STAIR TREADS

That BATES fillet weld gives you the full strength of the original steel of main and cross bars, *without dirt-catching overflow of surplus metal around the fillet.* That's important.

Just as important, note that crisp, clean tread the entire length of cross bar—a feature you can get only with BATES Hex Cross Bar construction.

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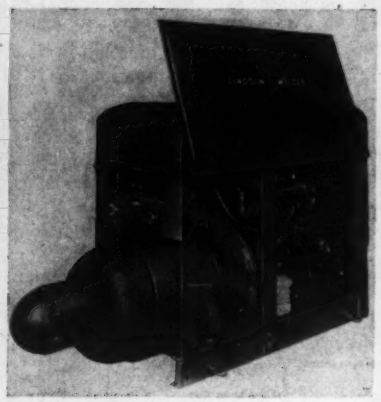
OPEN STEEL FLOORING • STAIR TREADS

a current range of 40 to 250 amperes.

The generator control or "job selector" controls engine speed from 1,500 to 1,150 rpm. for welding, and in addition may be used to manually reduce the



speed as low as 750 rpm. whenever necessary to stop welding at intervals of a few minutes. The generator can produce its rated current of 200 amperes, it is claimed, when the "job selector" is set so that the machine operates at speeds as low as 1,200 rpm.—*The Lincoln Electric Co., Cleveland, Ohio.*

• • •

Midget Twist-Lock Receptacle

Plug-in-anywhere convenience is a leading feature of a new two-terminal midget twist-lock receptacle No. 2127 H. This device, designed for installation in No. 2100 plugmold, available in 15-ampere, 125-volt, and 10-ampere, 250-volt capacities, is said to extend the utility of wiring systems along work benches and assembly lines.—*Wiremold Co., Hartford 10, Conn.*

• • •

Oil Remover

Said to be economical, safe and sanitary, a new oil and grease remover, called "Flix," removes all types of oil

from the skin, leaving it clean and dry. It is a hand-sized, semi-quilted pad con-

PENSTOCKS

Designed for quality, economy and long life. Fabricated from Class "A" steel, alloy steel or wrought iron.

Consult Lancaster's experienced engineers when you have a problem in fabricated steel plate work. Complete designs and estimates will be submitted with no obligation to you. Write, 'phone or wire today.

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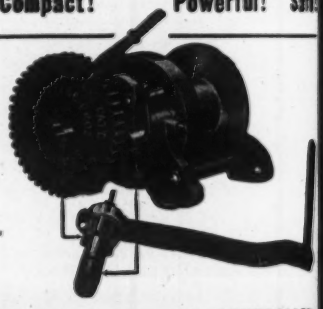

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1200' assembled pipe (132 Tons) were lowered to bed of Mississippi at St. Paul with 9—5-Ton Beebes, three lines to each hoist through blocks.

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Longest wooden trusses in world were installed with ONE 5-Ton Beebe after power hoists proved impractical.

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Supplied with a 2⅜" and a 1¾" head. These two heads give user a vibrator efficient in and suitable for a wide range of applications. For instance, from wall sections of comparatively large size to narrow sections.

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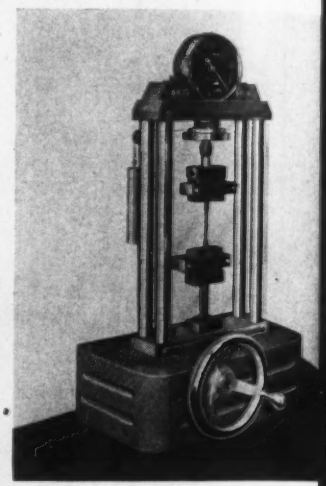
taining an absorbent sub-tance, wh in addition to its cleansing proper also prevents skin diseases, accordin the manufacturer's announcement.

Flix has also been found effectiv wiping excess oil off machinery. It not readily burn, even when oil-soak —*Waverly Petroleum Products C Philadelphia 6, Pa.*

• • •

Portable Tensile Tester

Only 132 lb. in weight and 25 high, a new portable tensile tester seven intermediate and interchange indicators ranging from 0-250 to 0-000 lb. Its new holder, for standar



wedge serrated grips, aids in the h dling of such loads, and the grips p mit rapid specimen insertion and r moval, by means of raising or lower sliding outer holders.

If desired, this hand-driven tester c be readily motorized, and can be o tained with a metal floor cabinet hav specimen space and room and shelf motor installation.—*W. C. Dillon & C 5410 West Harrison, Chicago 44, Ill.*

• • •

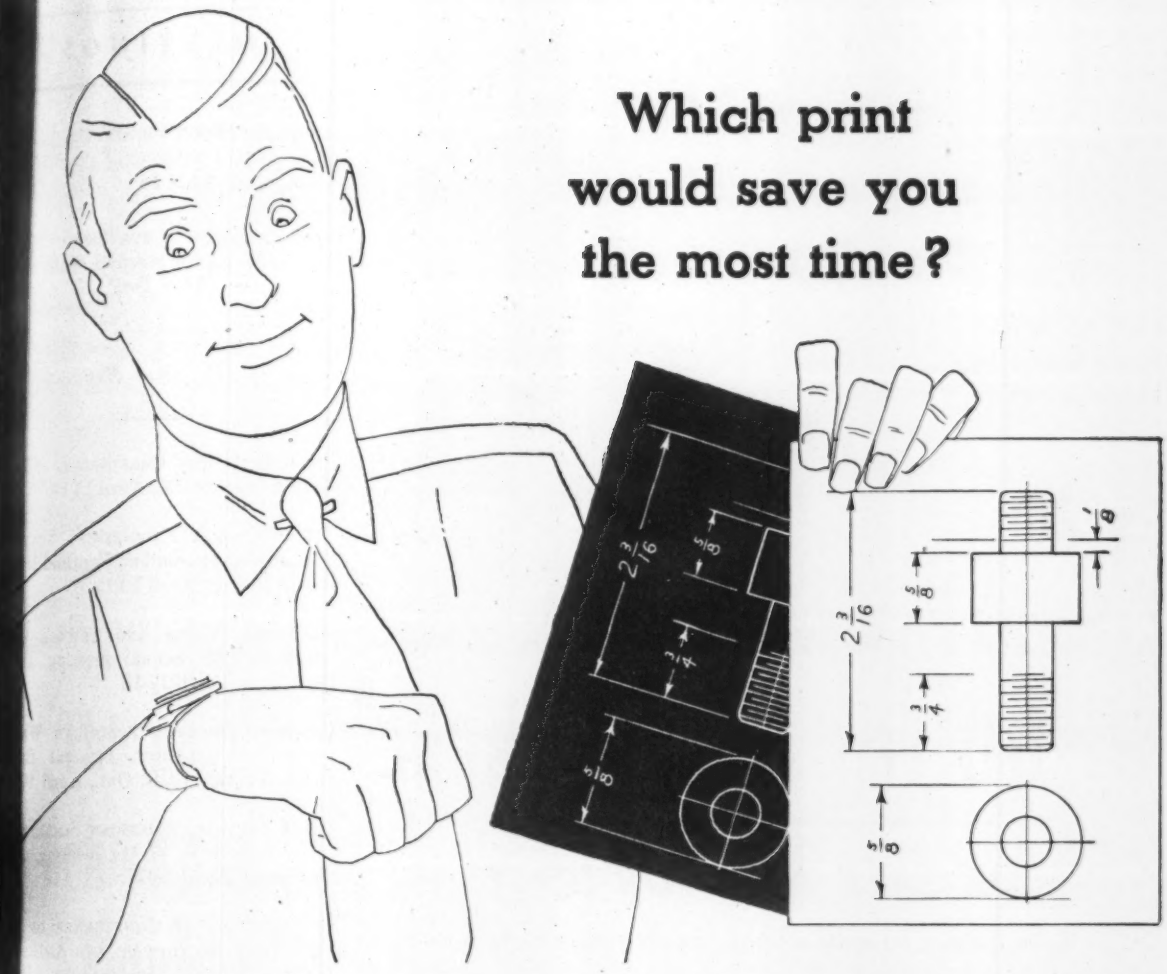
Waterproofing Spray Gun

Said to offer important savings in t and labor, and to provide thorough a uniform application on steel, concr or brick, the new R.M.S. "Fibre-Gu sprays sealing, waterproofing and in ating compounds at the rate of 4 t gal. per minute.

This non-clogging gun, weighing l than 5 lb., is easy to handle and cl and is constructed to withstand ru usage.

Designed primarily to handle bi materials and fibrated compounds, t spray gun may also quickly be adap for spraying lighter paints or o liquids.—*Stephenson Air Brush Pa Co., 1630 Webster St., Oakland 12, C*

Which print would save you the most time?



ON A TIME-SAVING basis alone, you'd prefer the Bruning Black and White Prints to blue prints. BW (black line) Prints take the wasted hours and sted motion out of print-making.

t requires five operations to produce blue prints—only *two* to produce a Bruning BW Print. Blue nts need washing and drying—BW Prints need no shing and are delivered dry. Blue prints require mming—while BW Prints can be made on sheets cut the exact size of your tracings. Blue prints are hard read, often causing confusion and errors—while easy-ding BW Prints save production time and money.

No wonder so many print makers say that BW Prints actually cost less than blue prints, all things considered.

Bruning Black and White printing and developing equipment is available for every production capacity. These modern machines take up little floor space—are easily installed because they need no plumbing or complicated electrical connections. In the complete Bruning line, there is a BW machine exactly suited to your needs. Consult a Bruning representative! CHARLES BRUNING COMPANY, INC.

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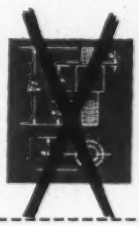

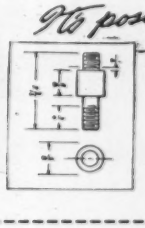

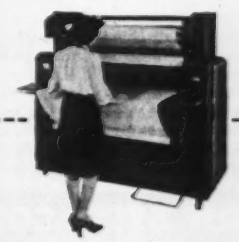

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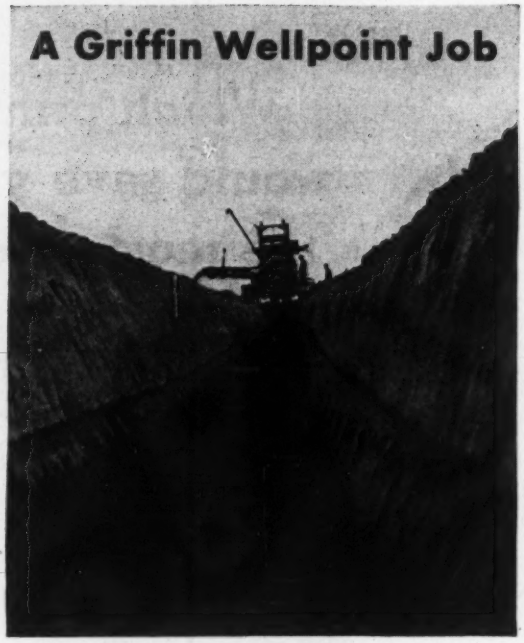

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MEETINGS

AMERICAN WOOD PRESERVERS ASSOCIATION, annual meeting, Palmer House, Chicago, Ill., April 26.

AMERICAN SOCIETY FOR TESTING MATERIALS, 47th annual meeting, Waldorf-Astoria Hotel, New York, N. Y., June 26-30.

REGIONAL AND LOCAL MEETINGS

MIDWEST POWER CONFERENCE, Palmer House, Chicago, Ill., April 13-14.

THE MICHIGAN ENGINEERING SOCIETY, 64th annual convention, Pantlind Hotel, Grand Rapids, April 13-15.

ARKANSAS WATER AND SEWAGE CONFERENCE, 14th annual meeting, Little Rock, Ark., April 17-18.

CANADIAN SECTION, AMERICAN WATER WORKS ASSOCIATION, General Brock Hotel, Niagara Falls, Ont., April 19-2

TEXAS SECTION, AMERICAN SOCIETY OF CIVIL ENGINEERS, spring meeting, Austin, Texas, April 26-27.

THE SPRING WAR CONFERENCE OF THE NEW YORK SECTION OF THE AMERICAN WATER WORKS ASSOCIATION, Hotel Utica, Utica, N. Y., April 27-28.

FLORIDA ENGINEERING SOCIETY, annual meeting, Miami Beach, Fla., April 27-2

SOUTHEASTERN SECTION AMERICAN WATER WORKS ASSOCIATION 1944 meeting, Greenville, S. C., May 8-10.

NEW JERSEY SECTION, AMERICAN WATER WORKS ASSOCIATION, Trenton, N. J., May 11.

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DIVISION OF
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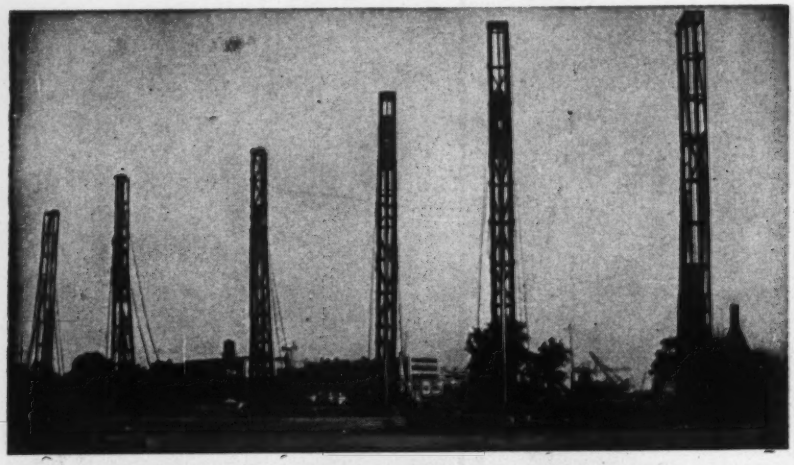

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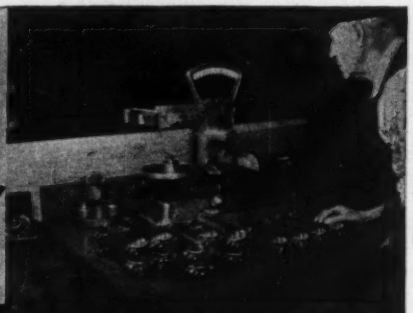

Every connecting rod, in every Wisconsin Air-Cooled Engine, is precision-balanced to eliminate all weight variations in excess of ¼-ounce per rod.

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NEW ENGLAND SEWAGE WORKS ASSOCIATION, spring meeting, Hotel Kimball, Springfield, Mass., May 17.

SOCIETY FOR EXPERIMENTAL STRESS ANALYSIS, The Hotel Statler, Boston, Mass., May 18-20.

MARYLAND-DELAWARE WATER AND SEWERAGE ASSOCIATION, 18th annual conference, Lord Baltimore Hotel, Baltimore, Md., May 19-20.

CENTRAL STATES SEWAGE WORKS ASSOCIATION, annual convention, Oshkosh, Wis., June 22-24.

Elections and Activities

At a recent meeting of the Alabama Section, American Society of Civil Engineers, the following officers and directors were elected: R. A. Smallman, Birmingham, president; A. Reese Harvey, Montgomery, first vice-president; Truman A. Smith, Mobile, second vice-president; J. F. Tribble, Montgomery, secretary-treasurer. Board members elected were: T. M. Lowe, Auburn; S. J. Cumming, Tuscaloosa; R. B. Kulp, Fairfield; T. F. Hobart and H. A. Davies, Birmingham.

H. B. Wolfe has been elected president of the Charlotte, N. C., Engineers' Club. Other officers are: Beaumert Hill Whitton, vice president; Charles M. Stone, secretary; J. L. Greenlee, treasurer; and David Clark, J. T. Meador, A. Z. Price and Glenn Parks, directors.

Clarence Waterfall of Ogden, Utah, recently was elected president of the Intermountain Branch, Associated General Contractors of America. Owner of the Clarence Waterfall Co., contractors, he served as vice-president before succeeding J. P. Gibbons, outgoing president.

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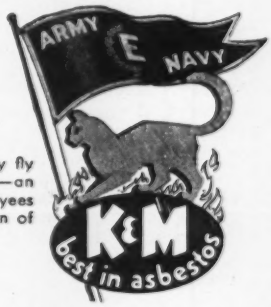

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dent. Joseph W. Grant of Strong & Grant, contractors, Springville, Utah, was elected vice-president. J. H. Tempest was re-elected secretary-treasurer.

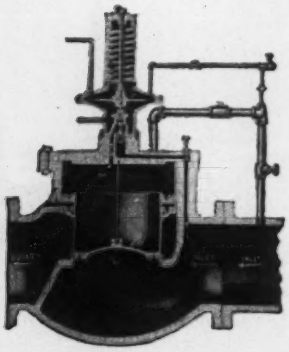
New officers of the Texas Society of Professional Engineers are: A. F. Mitchell, Corsicana, Texas, president; C. W. Mier, Dallas, and James P. Exum, Austin, vice presidents; and R. B. Cruise, Beaumont, national director.

Officers elected to direct the newly formed Wisconsin Society of Professional Engineers for this year are: Prof. M. O. Withey, University of Wisconsin, president; W. J. Urban, Milwaukee, first vice-president; E. W. Seeger. Milwaukee, second vice-president; O. J. Muegge, Madison, secretary and L. M. Schindler, Appleton, treasurer. The board of directors include: Hans P. Dahlstrand, W. D. Bliss, acting dean of the Marquette University engineering school, and Ernest Szekely, all of Milwaukee, and W. A. Pierce, Racine. L. E. Peterson of Milwaukee, is the national representative, and Prof. Ben Elliott, University of Wisconsin is the alternate.

The Lower Colorado River Authority recently elected Roy Fry, Burnet, Tex., chairman of the board of directors; Clay Kuykendall, San Saba, vice chairman; and Raymond Brooks, Austin, secretary.

The 50th annual meeting of the Ontario Good Roads Association was held recently in Toronto. J. N. Allen, of Dunnville was elected president, succeeding Guy R. Marsden; W. H. Keith of Guelph was elected vice-president, and T. J. Mahoney of Hamilton continues as secretary-treasurer.

A. F. Mitchell of Corsicana was elected president of the Texas Society of Professional Engineers recently. Others elected were: C. W. Mier of Dallas, first vice-president; James P. Exum of Austin, second vice-president, and R. B. Cruise of Beaumont, national director.



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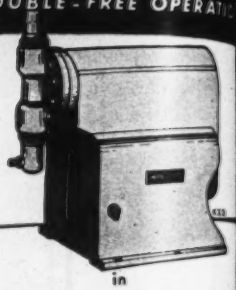

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